JOHNSON
CONTROLS

TECHNICAL BULLETIN

Auxiliary Gear

* Indicates those sections where changes have occurred since the last printing.

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Introduction

This document describes accessories used with various Johnson Controls Application Specific Controllers (ASCs), such as the Air Handling Unit (AHU) controller, Unitary (UNT) controller, Variable Air Volume (VAV) controller, Variable Air Modular Assembly (VMA), DX-9100, TC-9100, XTM, and XT-9100. The accessories in this document include:

- Actuators
- AS-CBLPRO-2
- AS-CBLCON-0
- AS-CVTPROx00-0
- Function Module Kit (FMK)
- MM-CVT101-0
- Relays
- Transformer Modules

Actuators

M100C
Actuator
Description

The M100C Series Motor Actuator is used in damper and valve applications where proportional control from a digital controller is required. The M100C communicates with AHU/UNT/VAV controllers depending on the position of the 8-pin DIP switch.

Wiring M100C
Actuators
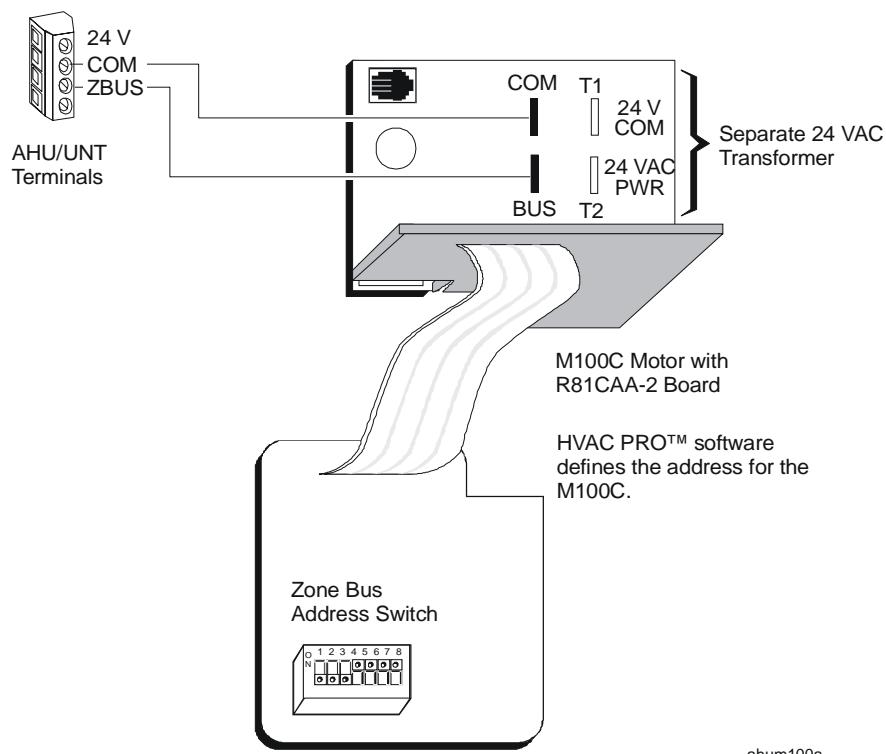
**Figure 1: M100 Motor Zone Bus Connection
Using R81CAA-2 Board**

When you connect an M100C Actuator to the Zone Bus, its own 24 VAC (Volts Alternating Current) transformer must power it. Multiple M100s each require an individual transformer. The only connections between the AHU/UNT/VAV and M100C are from the ZBUS and COM terminals of the AHU/UNT/VAV to the BUS and COM terminals in the M100C. A separate 24 VAC transformer is required to power the M100C. Refer to Figure 1 for terminal locations when wiring an M100 Actuator.

Note: Zone Bus address switch settings are determined by the controller configuration. The Zone Bus address is set to match the address assigned in the HVAC PRO software.

> ⚠ CAUTION: **Equipment Damage Hazard.** Connecting the 24 VAC of the terminal block from the ASC (AHU, UNT, VAV) to the M100C can possibly damage the transformers.

Switch Settings

M100c09
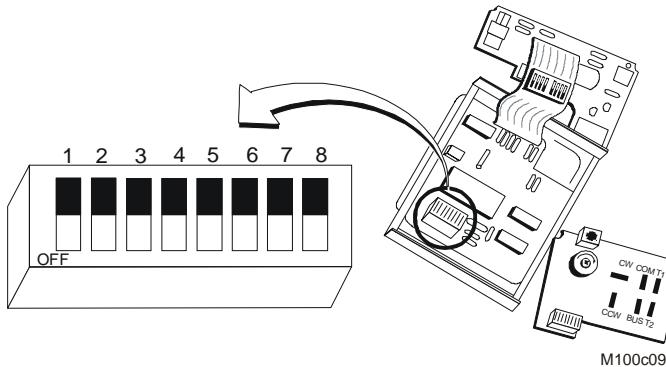
Figure 2: Digital Circuit Board

Make field adjustments using the 8-position DIP switch located on the cover-mounted circuit board as shown in Figure 12. The position of these switches specifies the operating parameters as shown in Table 1.

Table 1: Switch Settings

Switch Number	On Function	Off Function
1	Slave	Master
2	S-curve	Linear
3	Reverse Acting	Direct Acting
4	Zone Bus	L1 Bus (DSC 1000 product line)
5	Address Selection*	Address Selection*
6	Address Selection*	Address Selection*
7	Address Selection*	Address Selection*
8	Address Selection*	Address Selection*

*Refer to the *Master/Slave* section in the *M100C Series of Motor Actuators with Proportional Digital Control Signal Input and R81C Interface Board (LIT-121347) Technical Bulletin* located in the *Installation Sheets Manual (FAN 121)* for complete address selection options.

> ⚠ CAUTION: Disconnect the electrical power supply before attempting to adjust the switch settings.

Zone Bus

AHU/UNT/VAV controllers use the Zone Bus. Set Switch 4 to the On position to allow up to eight zone actuators to communicate with the AHU/UNT/VAV controllers.

Zone Bus Address Selection

An address is a numeric code that precedes a controller's command to a controlled device. The controlled device will respond only to a command preceded by its assigned address code number.

The positioning of Switches 5, 6, 7, and 8 provides address information to the controller. The switches are each positioned such that the sum of their individual values provides the desired address value.

Configure multiple actuators with a separate address when each one performs a different function. When they all perform the same function, set one unit as the master, with the remaining units on that address set as slaves.

AHU/UNT/VAV Controller Zone Bus Address Selection

The Zone Bus addresses used by the AHU/UNT/VAV controller are 20 through 27. Make the address assignment during the HVAC PRO configuration process for Analog Outputs (AOs). Refer to the *HVAC PRO User's Manual (FAN 637* or *1637.5)* for details.

> ⚠ CAUTION: The phone jack connector on the terminal board is for easy, single-point connection of the HVAC PRO service device (laptop PC [Personal Computer]). **Do not** connect any other device at the phone jack. Connection of another device at the phone jack may result in damage to the equipment or wiring.
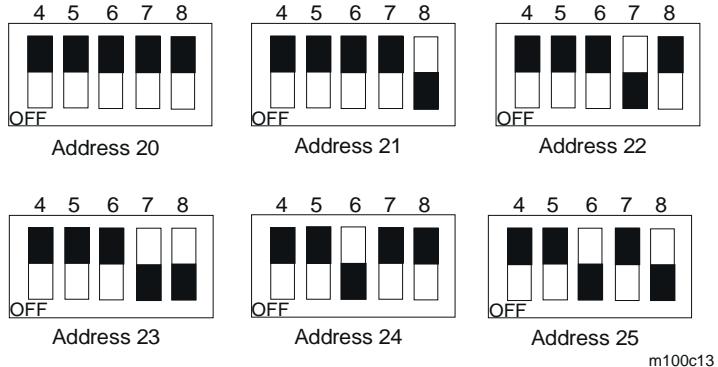
Figure 3: AHU/UNT/VAV Zone Bus Address Switch Settings

Table 2: AHU/UNT/VAV Address Switch Values

Switch Number	On Value	Off Value
5	0	—
6	0	4
7	0	2
8	0	1

For selection of Zone Bus, Switch 5 **must** be On and an additional value of 20 added to the total of the switch settings. For example: to select L1 Address 25, set Switches 6 and 8 Off and Switches 5 and 7 On ($25 = 0 + 4 + 0 + 1$ from the switch settings and +20 because of Zone Bus selection). Use the switches to select any Zone address between 20 and 27.

M100C
Specifications

Table 3: M100C Specifications

Product	M100C Motor Actuator
Power Requirements	24 VAC at 50/60 Hz, 25 VA spring return, 20 VA non-spring return
Rotation Timing	60 seconds for 160º travel
	38 seconds for 90º travel
Ambient Operating Conditions	-40 to 52ºC (-40 to 125ºF), 90% RH non-spring return
	-37 to 52ºC (-35 to 125ºF), 90% RH spring return
Ambient Storage Conditions	-40 to 52ºC (-40 to 125ºF), 90% RH
Dimensions (H x W x D)	143 x 111 x 125 mm (5.64 x 4.38 x 4.94 in.)
Shipping Weight	4.1 kg (9 lb)
Enclosure	NEMA-1
Agency Compliance	FCC, UL, CSA
Agency Listing	UL Recognized File E27734 Guide XAPX2
	CSA Certified Temperature Indicating and Regulating Equipment

The performance specifications are nominal and conform to acceptable industry standards. For application at conditions beyond these specifications, consult the local Johnson Controls office. Johnson Controls, Inc. shall not be liable for damages resulting from misapplication or misuse of its products.

AS-CBLPRO-2

AS-CBLPRO-2 Description

The AS-CBLPRO-2 (Cable PRO) is an interface device for use between a computer running Configuration Tools software and Application Specific Controllers (ASCs) or Lab and Central Plant (LCPs) controllers. Exceptions to these are the DX-9100, TC-9100, XT-9100, XTM, and DT-9100. It is used for downloading, uploading, or commissioning a configuration via the Zone Bus communication port on the controller.

When used with a Zone Bus device, such as the ASC or Zone Terminal Unit (ZTU), the Cable PRO is strictly an electrical interface between the serial RS-232 port of the computer and the Zone Bus. The Cable PRO uses either a 6-pin to 8-pin cable or a 6-pin to 6-pin cable to connect to an AHU, VAV, and UNT. The Cable PRO operates on 24 VAC drawn from the controller over the wire used to make the Zone Bus connections. The data rate on both the RS-232 and the Zone Bus is 1200 baud.

The connection to the RS-232 COM port of the computer is by means of a DB9 or DB25 connector supplied with the AS-CBLPRO-2. After connecting it, make sure the Cable PRO is 0.3 meters (1 foot) or more away from the computer monitor and system unit.

IMPORTANT:	Do not position the Cable PRO near the computer monitor or Personal Computer (PC). Communication can be disrupted by the electromagnetic noise emitted from that equipment.
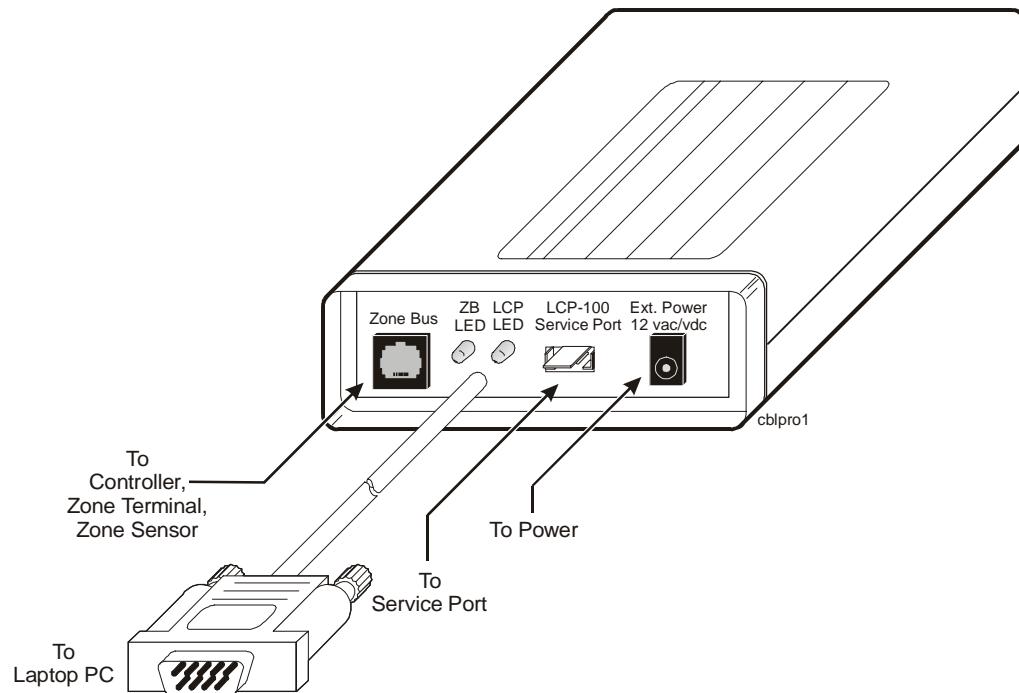
Figure 4: AS-CBLPRO-2

The AS-CBLPRO-2 (Figure 4) is an improved model of the original Cable PRO AS-CBLPRO-0, -1. It has the following improvements:

- The laptop PC cable is permanently attached to the Cable PRO, making PC attachment more convenient.

- The unit has protection against earth ground faults that may be introduced into the system.

- A diagnostic Light-Emitting Diode (LED) indicates the status of communication of the Zone Bus. Descriptions of this LED is printed on the unit and summarized in Table 4.

Table 4: AS-CBLPRO-2 LEDs

ZB LED	LCP LED	Normal and Fault Conditions
2 Flashes per Second	Off	Connected to the Zone Bus Normal Communication
Off	2 Flashes per Second	Connected to the LCP Normal Communication
1 Flash per Second	Off	Connected to the Zone Bus via RS-232 Communication, **or** 24 VAC Shorted to Zone Bus
5 Flashes per Second	5 Flashes per Second	24 VAC High Side Shorted to Earth Ground Note: Remove ground fault and cycle CBLPRO power to eliminate this fault condition.
On	Off	Controller Common Shorted to Zone Bus
Off	On	LCP Common Shorted to LCP Data Terminal **or** Interrupted Communication
Off	Off	No Power or No Connection to Active Zone Bus **or** No Power or No Communication for LCP

Note: With the VMA, the LEDs only flash when sending or receiving data.

***AS-CBLPRO-2
Connection***
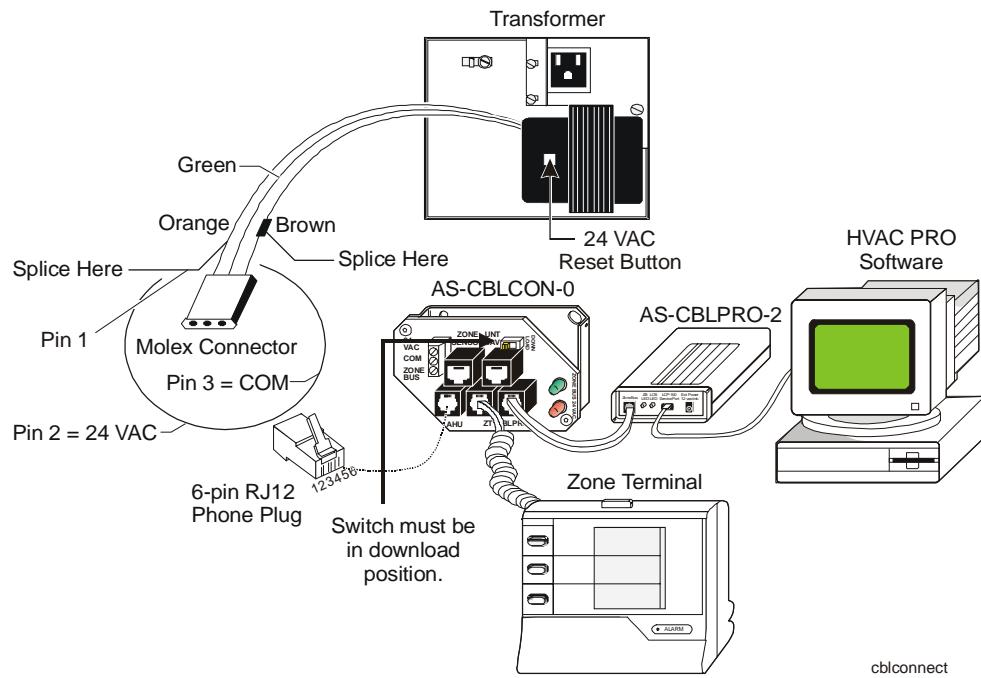
Figure 5: AS-CBLPRO-2 Connection Example

AS-CBLPRO-2
Specifications

Table 5: AS-CBLPRO-2 Specifications

Product	AS-CBLPRO-2
Power Requirements	24 VAC from controller
Ambient Operating Conditions	N/A (Test equipment only)
Ambient Storage Conditions	-18 to 50ºC (0 to 120ºF)
Dimensions (H x W x D)	33.2 x 94 x 159 mm (1.3 x 3.7 x 6.25 in.)
Shipping Weight	0.63 kg (1.38 lb)
Agency Compliance	N/A
Agency Listing	N/A

The performance specifications are nominal and conform to acceptable industry standards. For application at conditions beyond these specifications, consult the local Johnson Controls office. Johnson Controls, Inc. shall not be liable for damages resulting from misapplication or misuse of its products.

AS-CBLCON-0

AS-CBLCON-0 Description

The AS-CBLCON-0 Cable Connector (Figure 6) is a cable connecting device that accepts the different sizes of telephone cable connectors used with the controller products so that they are able to communicate. It also monitors Zone Bus communications to the ASC or ZTU by red and green Light-Emitting Diodes (LEDs) described in Table 6. It has a terminal strip and a ZT download switch.

To download the ZTU, slide the switch on the AS-CBLCON-0 to the download position. The red LED is indication of 24 VAC power. The green LED shows Zone Bus transmissions from the controller. If the green LED is off, the Zone Bus wire is open. If this LED is on solid, the Zone Bus is shorted to Common. For details, refer to the *Zone Terminal Technical Bulletin (LIT-6363014* or *LIT-1628330)* in *FAN 636.3* or *1628.2.*

The AS-CBLCON-0 also extends the ZTU from 15.2 m (50 ft) to 154.2 m (500 ft) with 18 AWG wire size.

Table 6: AS-CBLCON-0 LEDs

Red LED-Power	Green LED–Comm	Cause
OFF	OFF	No power to controller
ON	OFF	Zone Bus wire open
ON	ON	Zone Bus wire shorted to Common or CBLCON-0 switch in download position
ON	Blinking	Normal communications
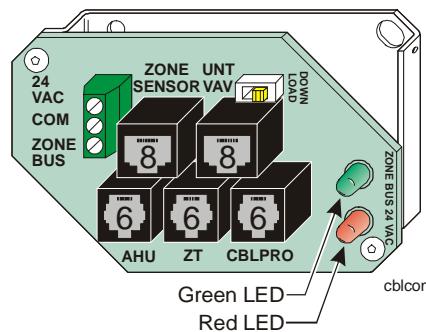
Figure 6: AS-CBLCON-0 LEDs

AS-CBLCON-0 Connection

Figure 5 in the *AS-CBLPRO-2 Connection* section of this document shows an example connection using the AS-CBLCON-0.

AS-CBLCON-0 Specifications

Table 7: AS-CBLCON-0 Specifications

Product	AS-CBLCON-0
Power Requirements	N/A (No active circuits, only indicators.)
Ambient Operating Conditions	0 to 50ºC (32 to 120ºF)
Ambient Storage Conditions	-40 to 60ºC (-40 to 140ºF)
Dimensions (H x W x D)	31.8 x 47 x 73.7 mm (1.85 x 1.25 x 2.90 in.)
Shipping Weight	0.163 kg (0.36 lb)
Agency Compliance	N/A
Agency Listing	N/A

The performance specifications are nominal and conform to acceptable industry standards. For application at conditions beyond these specifications, consult the local Johnson Controls office. Johnson Controls, Inc. shall not be liable for damages resulting from misapplication or misuse of its products.

AS-CVTPROx00-0

AS-CVTPROx00-0 Description

The AS-CVTPROx00-0 Zone Bus/N2 Bus Interface Converter serves as a converter between room sensors/controllers communicating over the Zone Bus or N2 Bus and a user interface. The interface is either a Palm™ III family compatible handheld device or a PC.

Notes: An adapter is required to use Palm V devices. The Dock V PRO™ adapter is available from Solvepoint Corporation at www.palmdock.com and local retailers.

Other Palm models have not been fully tested with the CVTPRO and should not be used.

The CVTPRO Zone Bus/N2 Bus Interface converter comes complete with four connection cables. There are two external power options available for N2 communication: 120 VAC to +3 VDC (Volts Direct Current) adapter (included with the CVTPRO in North America) and 2 AAA batteries (not included). The CVTPRO is proven to be compatible with TC-9102's, AHUs, VAVs, UNT1xxs, VMA 12x0/14x0 Series controllers, UNT1100s, TMZs, TE-6x00 sensors, GX-9100 tools, DX-9100 tools, DT-9100 displays, XTMs, and Network Dialer Modules (NDMs). CVTPROs work with VMA Balancing Tool (VBT) software for the VMA1200 and VMA1400; Windows® 98 and Windows NT®, and Palm Operating System (OS) Version 2.x or later.

The CVTPRO converter is not compatible with the Zone Terminal Unit (ZTU).

See the *AS-CVTPROx00-0 Zone Bus/N2 Bus Interface Converter Technical Bulletin (Part No. 24-9544-0)* (shipped with the product) for specific interoperability information.

Physical Description

The back of the CVTPRO converter has ports for connection with a PC (via the Rigid Metal Conduit [RMC] –9 port), incoming power source, and the Zone Bus/N2 Bus RJ11 jack (Figure 7). This view also shows the back of the RS-232 connector that slides into the Palm device or adapter.

RS-232 Connector to Palm III Device
or Adapter for Palm V

AS-CVTPRO

Zone Bus/
N2 Bus Port
RJ11 Jack
6-Pin

PC Port

Power Input

cvtdorsal
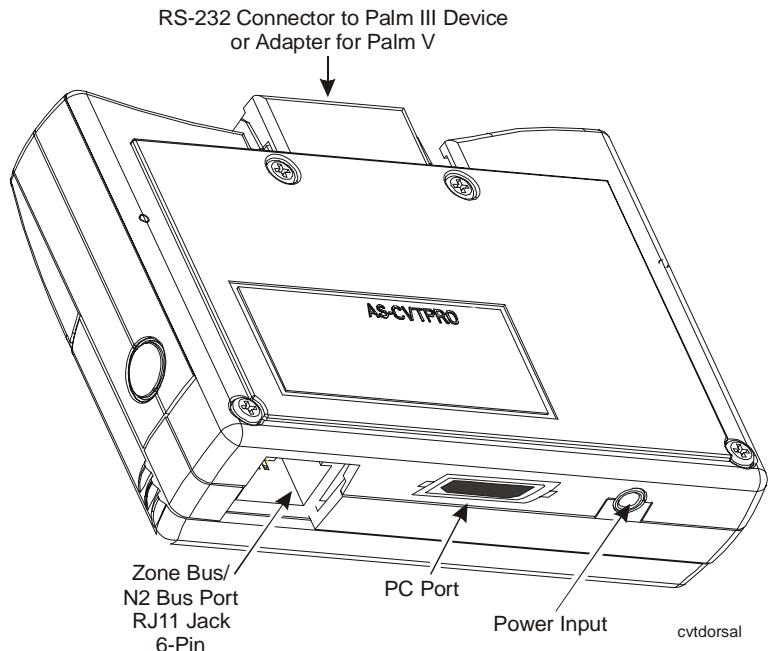
**Figure 7: Back of CVTPRO**

The front of the CVTPRO converter shows another view of the RS-232 connector (Figure 8). The Light-Emitting Diodes (LEDs) display the status of the unit relative to the field device.

RS-232 Connector to Palm III Device
or Adapter for Palm V Device

Yellow LED
(Receiving)

Green LED
(Transmitting)

Red LED
(Power)

Battery Cover

cvtfront
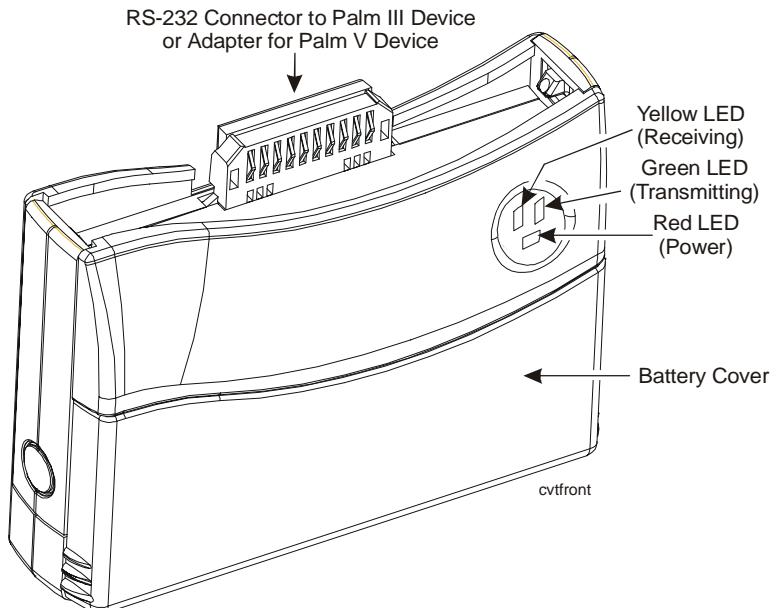
Figure 8: Front of CVTPRO

Figure 9 shows the terminations of the 6-pin phone cable used by the CVTPRO for N2 Bus communication. For Zone Bus communication, always use standard Zone Bus cables.

Blue (N2+)   White (N2-)
Red (N2 REF)
phonewire
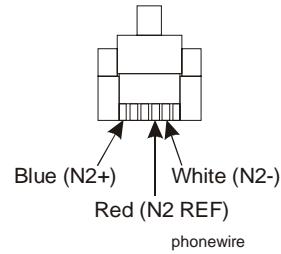
Figure 9: N2 6-Pin Phone Cable Terminations

AS-CVTPROx00-0 Connection

Figure 10 is a diagram of the connections possible between the CVTPRO and other devices. Refer to Table 9 for more information on the cables used with the CVTPRO.

*Notes: Do not connect the CVTPRO to the Palm device and the laptop or PC at the same time.

Unplug the Palm device from the CVTPRO when not in use to conserve battery power.

Palm III or Adapter for Palm V *

TE-6x00/TMZ Room Sensor
RJ11 Jack, 6-Pin

RS-232 Port

Zone Bus

CVTPRO

Compatible Controller

External Power Source

PC Port

or

or

Zone Bus

RJ45 Jack, 8-Pin

DB9 Port

Zone Bus/ N2 Bus Port RJ11 Jack 6-Pin

N2 Bus

N2 Bus Interface, 4-Pin N2 Socket/ 3-Pin N2 Plug with Tab and Extra 4-Pin N2 Socket

Personal Computer *

cvtschematic
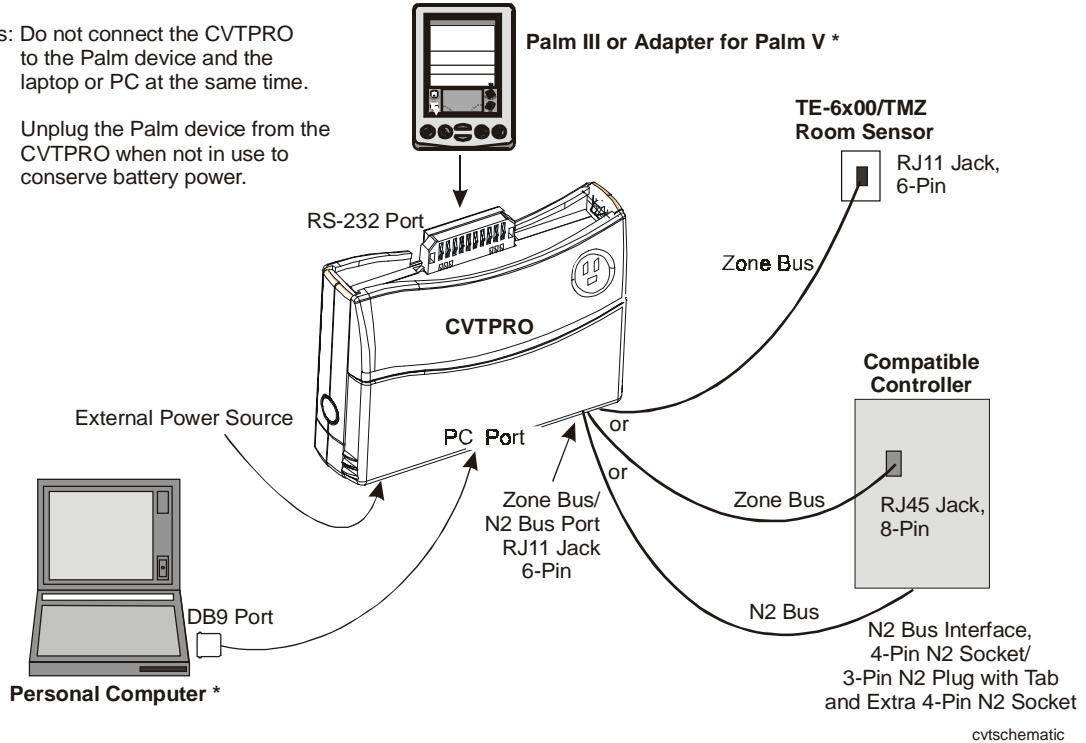
Figure 10: Overview of Possible CVTPRO Connections

Compatibility

The following table lists compatible tools, OSs, and controllers used over the Zone Bus and N2 Bus with the CVTPRO converter.

Table 8: Compatibility Chart

Tool	Bus	OS	Compatible Controller
HVAC PRO Software Release 8.01	N2 Bus	Windows 98SE, Windows NT	AHU1xx UNT1xx UNT11xx VAV10x VMA14x0 TMZ1600
	Zone Bus	Windows 98SE	
VBT1400	Zone Bus	Palm III or V (with adapter) with OS Version 2.x or later	VMA14x0
VBT1200	Zone Bus	Palm III or V (with adapter) with OS Version 2.x or later	VMA12x0
GX-9100	N2 Bus	Windows 98SE, Windows NT	DT-9100 DX-9100 XP91xx XTM-905 (XPx-xxx) XT9100
DX-9100 Configuration Tool	N2 Bus	Windows 98SE, Windows NT	DX-9100
XTM Configuration Tool	N2 Bus	Windows 98SE, Windows NT	XTM-105 (XPx-xxx)
NDM Configuration Tool	N2 Bus	Windows 98SE, Windows NT	NDM

Note: The CVTPRO converter is not compatible with Zone Terminal Units (ZTUs) at this time. For ZTUs, use the CBLPRO-2 converter.

Cables

Table 9: Cables Included with the CVTPRO

To Connect the CVTPRO to This…	Use the Cable with These Terminations:
PC	DB9 and RMC-9 (457 mm [18 inches])
Palm III Compatible Device	No cable needed
Controller via the Zone Bus	8-pin RJ45 and 6-pin RJ11 phone cable (1.8 mm [6 ft])
Controller via the N2 Bus	4-pin N2 socket/3-pin N2 plug with tab and 6-pin RJ11 phone cable (1.8 m [6 ft]) Note: Extra CVTPRO 4-pin N2 socket required for older AHUs and similar devices.
TE-6x00/TMZ Room Sensor via the Zone Bus	6-pin and 6-pin RJ11 phone cable (1.8 m [6 ft])

AS-CVTPROx0-00 Specifications

Table 10: General Specifications for the AS-CVTPROx00-0 Zone Bus/N2 Bus Interface Converter

Feature	Specifications
Power	**Zone Bus:** Controller or thermostat (+15 VDC [Volts Direct Current] or 24 VAC) **N2 Bus:** External Adapter 120 VAC to +3 VDC 200 mA (milliamperes) (included with CVTPRO converter in North America), or Batteries (2 AAA) (not included)
Ambient Operating Temperature	0 to 50°C (32 to 122°F)
Ambient Operating Humidity	20-80% RH (Relative Humidity) 30°C (86°F) maximum dew point
Ambient Storage Temperature	-40 to +60°C (-40 to 140°F)
Ambient Storage Humidity	5-95% RH 30°C (86°F) maximum dew point
Battery	2 AAA batteries
Battery Life	Approximately 7.5 hours
Serial Interfaces	DB-9 PC Port for RS-232 Connector Zone Bus/N2 Bus RJ11 Jack (6-Pin)
Dimensions (H x W x D)	79.38 x 60.33 x 22.23 mm (3.125 x 2.375 x 0.875 in.)
Shipping Weight	0.227 kg (0.5 lb)
Agency Listings	UL listed and CE Mark
Agency Compliance	UL 916, UL 864 Plastic housing meets UL 94-5V CSA 22.2 No. 205 FCC Part 15, Subpart B, Class A CE Mark: EN50081-1 (Electromagnetic Compatibility, EN55011, Class B) EN50082-2 (Electromagnetic Compatibility, EN61000-3-2 and EN61000-3-3)

Function Module Kit (FMK)

***FMK
Description
(AS-FMK102-0)***

The Function Module Kit (FMK) provides the enclosure and termination board to connect up to four, single-slot function modules to the AHU.

**FMK Mounting
Procedures**

Two different mounting position options (UPM or perpendicular) are available when installing the FMK102 Function Module Kit. Built-in screw holes are provided for mounting the unit in the angled position. These holes are compatible with the Universal Packaging Module (UPM) enclosure. Use perpendicular mounting when replacing the FMK100 or in confined areas on various surfaces.

Note: Versions previous to the FMK102 are not supported in the UPM.
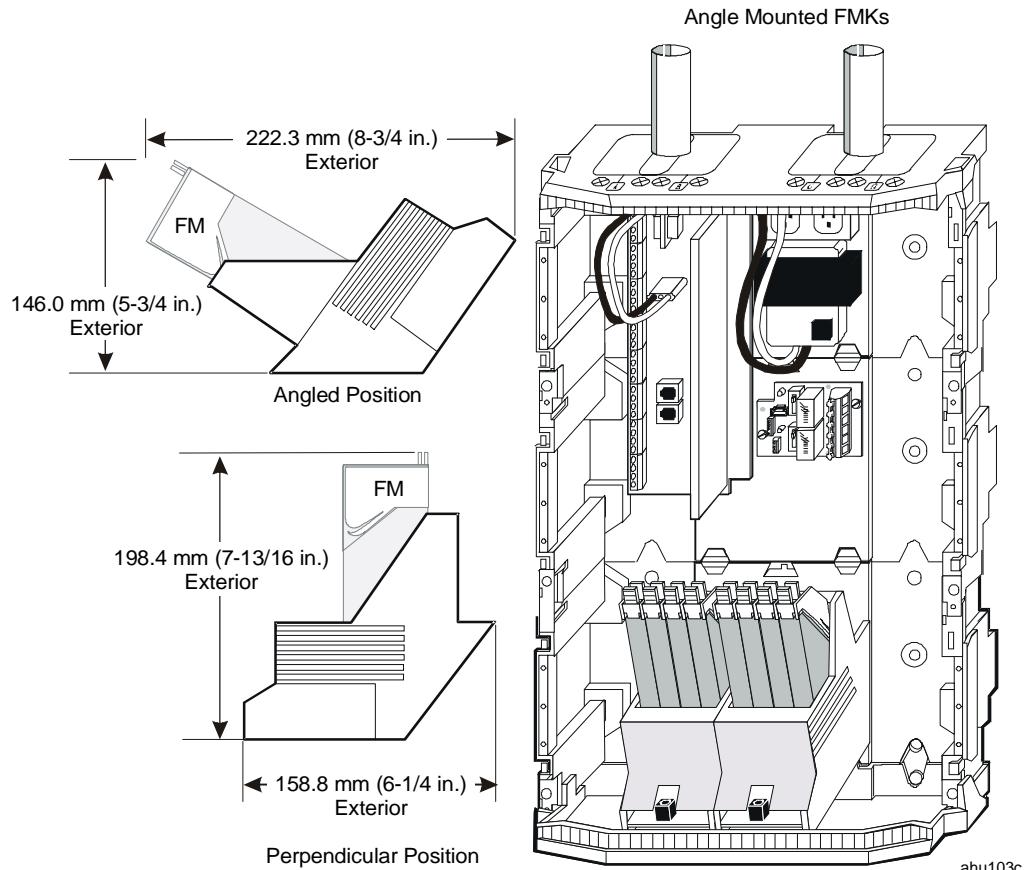

Figure 11: FMK Mounted in AHU103
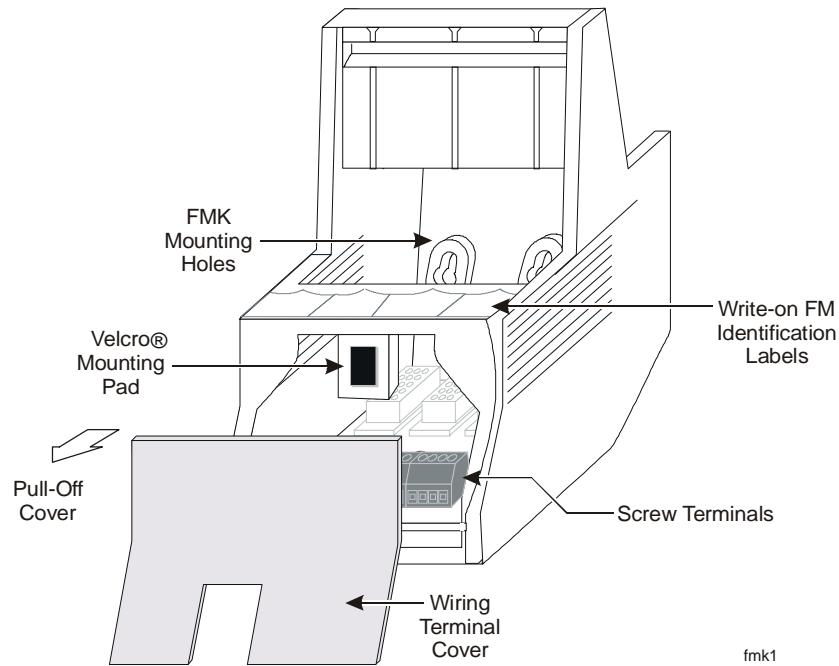
Figure 12: Function Module Kit

Refer to Figure 12 and follow the steps below when installing an FMK102 into the UPM or mounting in the horizontal position.

1. Remove all Function Modules (FMs) from the FMK102. The mounting holes are accessible through this area.

2. Position the FMK in the desired area of the UPM. Align the small end of the slotted mounting holes in the FMK with the grid pattern holes in the UPM. Mark these holes to reference the mounting area.

   Note: Ensure your selected mounting position will not interfere with door closure.

3. Set the FMK aside and install the two provided mounting screws in the desired holes. Insert the screws so there is approximately 1/2 inch thread visible.

4. Install the FMK mounting slots over the mounting screws. Slide the FMK into place. Position the screws at the small end of the slot. Tighten the screws to secure the FMK102.

5. When you have completed mounting the FMK102, you may go on to wire the unit. Remove the wiring cover, to access the wiring terminals, by firmly pulling the cover away from the unit. To reinstall the cover, align the cover and the unit and press firmly into place.

Function Modules (FMs)

The types of FMs provided for use in the FM kit are:

● Input: The input FMs consist of the FM-IAP and various models of the FM-IDP modules. Each occupies one slot in the FM kit.

● Output: The output FM (FM-OAP) has the same dimensions as the input FMs except it has twice the width. Therefore, the output FM occupies two slots in the FM kit. An FM-OAP102 Pneumatic Manual Module must be ordered with each FM-OAP103 Electronic Module.

Perpendicular Mounting and FMK100 Replacement

The FMK102 cannot be mounted on a DIN rail. Therefore, when you replace a DIN rail mounted FMK100, you must remove the DIN rail or install 1/4 inch mounting spacers so the FMK102 clears the DIN rail. Refer to Figure 13 and follow the steps below when mounting an FMK102.
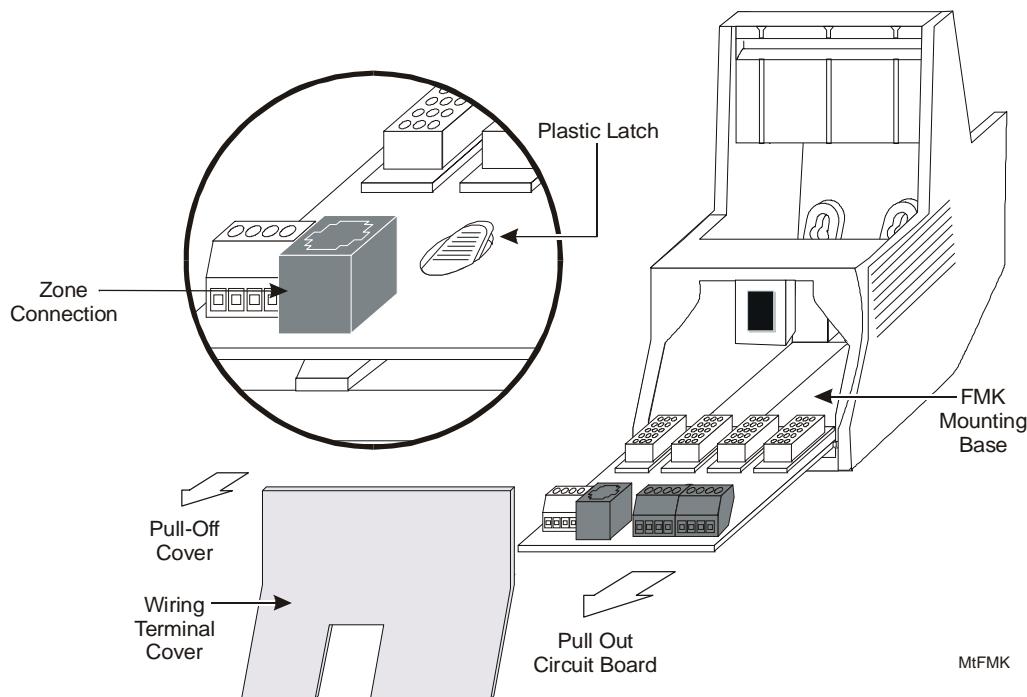

Figure 13: Mounting the FMK

To mount the FMK perpendicular on a wall or in an enclosure:

1. Remove the wiring terminal cover, pulling it off the unit (Figure 13).

2. Remove the printed circuit board from the unit by simultaneously pressing down on the plastic latch and pulling the board out of the unit.

3. Determine the required anchors and mounting screws for the mounting surface. Use three or four size No. 8 to No. 12 mounting screws.

   Note: Ensure the screw heads do not interfere with the FMK printed circuit board.

4. Position the FMK so there is clearance to install the FMs and wire the terminals. Refer to Figure 11 for dimensions.

5. Drill four holes in the corners of the FMK base. Remove the FMK and install the wall anchors if required. Reposition the FMK frame over the mounting holes and install the screws.

6. Reinsert the printed circuit board into the FMK frame. Ensure the board aligns into the guide slots and that the wiring terminals face the front of the unit. Push the board into the FMK until the plastic latch snaps into the board.

AHU100 Termination Board

AHU100
Analog
Outputs

AO1
AOCOM
AO 2
AO 3
AOCOM
AO 4
AO 5
AOCOM
AO 6

AO 2 Controls FM-OAP103
in Slots C and D

OR

J2

A

B

TB2

J3

C

D

J4

FM-OAP103

FM-OAP102

FM-OAP103

FM-OAP102

AS-FMK102-0

fmkwir
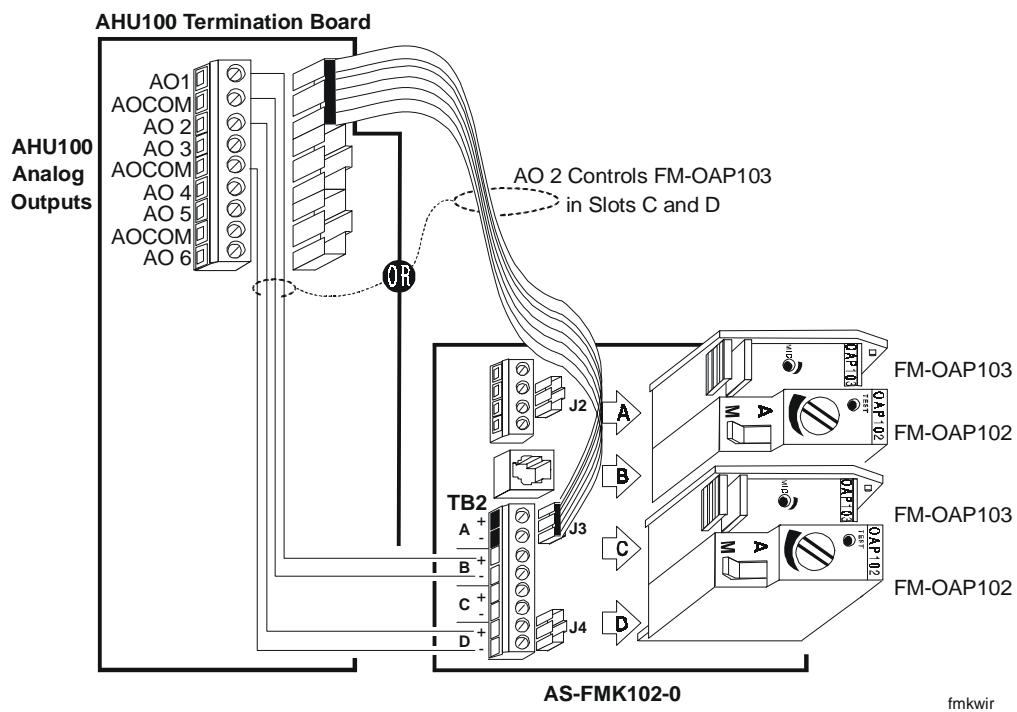
**Figure 14: AO1/AO2 Controlling Two FM-OAP103
Function Modules**

Refer to Figure 14 for terminal locations when using two FM-OAP103-0s
with the FMK. The FM-OAP 103-0 must use adjacent Slots A-B or C-D in
the FMK-102-0.

Note: Do not insert the FM-OAP 102/103 module into the two middle
        slots (B and C) of the FMK. Refer to Table 8 for slot allocation.

● either hardwire the FMK termination block Terminal B of the FMK for
  the top OAP module and hardwire terminal block Terminal D on the
  FMK for the bottom OAP

● or, use the 0.9 m (3 ft) AS-CBL100-0 Quick Connect Cable to connect
  consecutive AOs (for example, AO1 and AO2) to both FM-OAP103-0
  transducers by connecting the center connector (J3) on the FMK.

Refer to Figure 15 for terminal locations when using one FM-OAP-103/102
with the FMK. Refer to Table 8 for slot allocation.

● either hardwire from the AS-AHU100 Analog Output Terminal
  Block—if the FM-OAP103/102 is installed in the top half (Slot AB) of
  the FMK, use Terminals B+ and B- on the FMK. Use Terminals D+
  and D- if the FM-OAP103/102 is installed in the bottom half (Slot CD)
  of the FMK. The B+ or D+ connect to AO-n. The B- or D- connects to
  AOCOM

● or, use an AS-CBL100 Quick Connect Cable to connect the odd numbered AOs to the top quick connector (J2) of the FMK with the FM-OAP103/102 in Slots A and B. The next even numbered analog output is available for termination elsewhere. Use the bottom quick connector (J4) of the FMK with the FM-OAP in Slots C and D for even numbered AOs. The previous odd numbered analog output is available for termination elsewhere. For example, if you plug a CBL100 into AO3 and AO4, and into J4 of the FMK, then AO4 controls the OAP in Slot C and D. AO3 is available for hardwiring to another device.
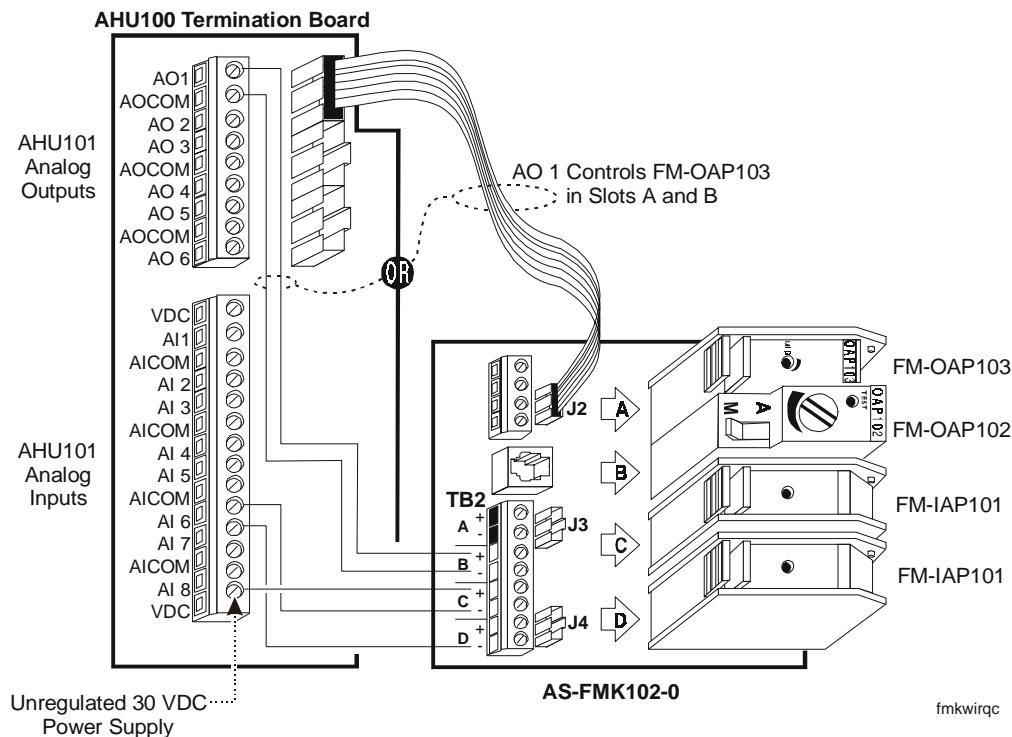
Figure 15: Single AO Controlling FM-OAP103/102 with AS-CBL100 and Hardwired Input Function Modules

> ⚠ CAUTION: The FM-IDP or FM-IAP uses the 30 VDC unregulated power supply. This supply voltage must be connected to a positive (+) terminal corresponding to the FMK slot holding the function module. Reversing this connection will damage the AS-AHU100 electronic board.
>
> When using FM-IDP or FM-IAP modules, the AS-AHU102 will continually reset if you forget to install the current (C) jumper for the appropriate Analog Input (AI).

Wiring Input (FM-IAP and FM-IDP) Modules

Refer to Figure 16 for terminal locations when wiring input modules.

Wire from the +VDC terminal on the AHU controller board to either the A+, B+, C+, or D+ terminal on the FMK. All four terminals are electrically connected on the FMK. Wire from each AI terminal on the controller board to the A-, B-, C-, or D- terminal on the FMK. Set the AI jumper on the AHU102 board to the current (C) position. One +VDC wire is sufficient per FMK, but it must be run in the same bundle as the AI wires and be large enough to carry current for all four inputs (80 mA maximum).
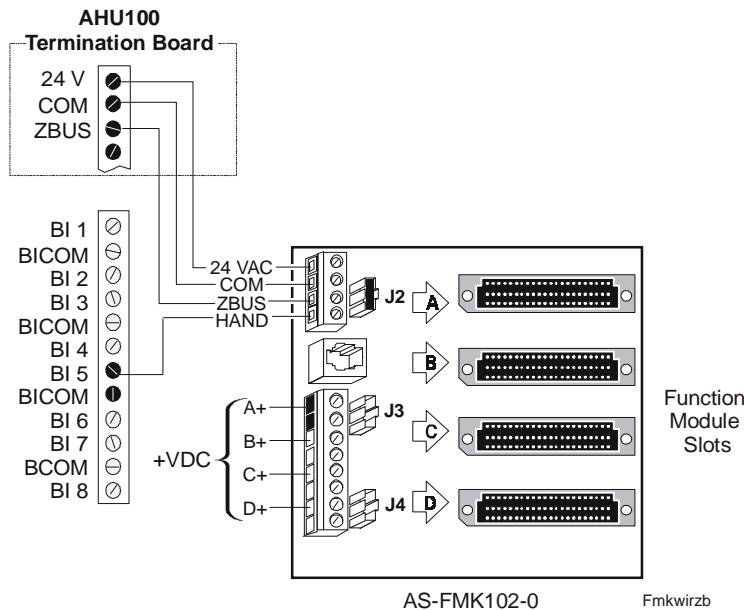

Figure 16: Zone Bus Connection with Manual Override Status Indication

Wire the 24V, COM, and ZBUS terminals from the AHU100 to the FMK102 to connect the Zone Bus from the AHU controller to the FMK102. You can use this common for the Hand/Manual Override Indicator Common.

The Hand/Manual Override Binary Indicator can be connected to a Binary Input (BI) and BICOM on the AHU controller board.

Refer to Figure 16 for terminal locations when monitoring Auto-Manual switch status.

1. Hardwire from the Hand terminal on the FMK102 to a BI point on the AHU100 controller board.

2. Hardwire from COM on the FMK102 to COM on the AHU100 if you use the Zone Bus. Hardwire from COM on the FMK102 to BICOM on the AHU100 controller board if you do not use the Zone Bus.

Note: Refer to Table 11 for complete wiring information.

Application Examples

In Figure 17 the AHU AI-1 connects to FMK connector CD for Input Differential Pressure (IDP) Function Module. Likewise, AI-2 connects to the Input Analog Pneumatic (IAP) Function Module in Slot D with the same CBL100.
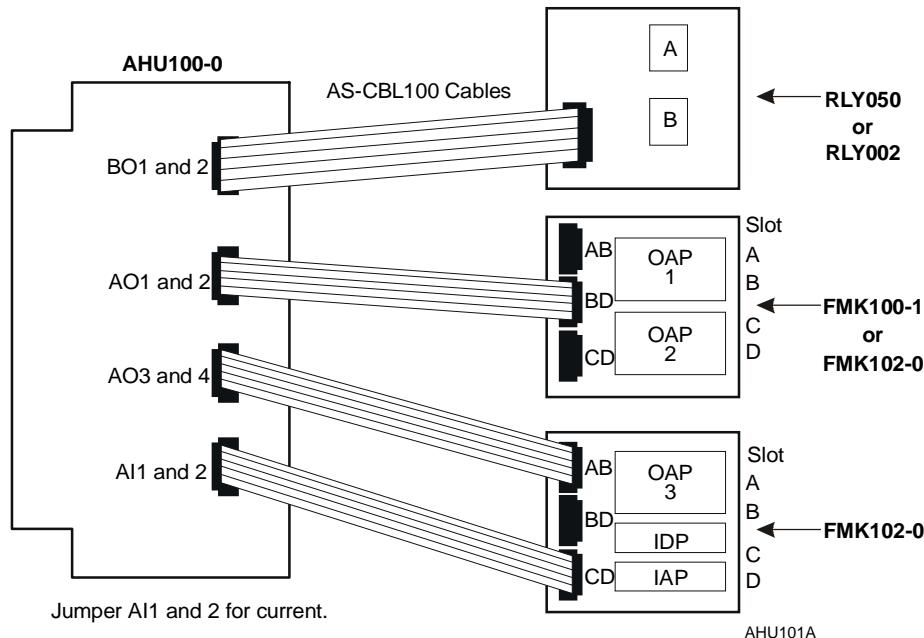
Figure 17: Application Example--Interconnect of AHU100-0 to FMK102-1

CBL100 Rules for Wiring the AHU to FMK102

Table 11 lists the general rules to remember when wiring the AHU to the FMK102.

Table 11: General Rules for AHU to FMK102 Wiring

Function Module	Function Module Slot	FMK Cable 100 Connector	AHU Point
IDP/IAP	A	AB (J2)	AI Even
IDP/IAP	B		AI Odd
IDP/IAP	C	CD (J4)	AI Odd
IDP/IAP	D		AI Even
OAP103	AB	AB (J2)	AO Odd *
OAP103	AB	BD (J3)	AO Odd
OAP103	CD		AO Even
OAP103	CD	CD (J4)	AO Even*

* You can separately hardwire the other output to another device.

Pneumatic Connection

For complete information on installing pneumatic function modules, refer to the *Output Analog Pneumatic (OAP) Technical Bulletin (LIT-636045)* in the *Metasys Network Technical Manual (FAN 636)*.

AS-FMK102-0 Specifications

Table 12: AS-FMK102-0 Specifications

Product	AS-FMK102-0
Power Requirements	None (supplied by controller)
Ambient Operating Conditions	32 to 122°F (0 to 50°C)
Ambient Storage Conditions	-40 to 158°F (40 to 70°C)
Dimensions (H x W x D)	146 x 114 x 156 mm (5.75 x 4.5 x 6.13 in.)
Shipping Weight	2 lb
Agency Compliance	UL 916, UL 864, CSA C22.2-205
Agency Listing	UL Listed and CSA Certified as part of Metasys® Network.

The performance specifications are nominal and conform to acceptable industry standards. For application at conditions beyond these specifications, consult the local Johnson Controls office. Johnson Controls, Inc. shall not be liable for damages resulting from misapplication or misuse of its products.

MM-CVT101-0

***MM-CVT101-0
Description***

Since PC serial ports use RS-232 signals and the N2 Bus uses RS-485 signals, it is necessary to connect a converter module between the serial port and the ASC, DX-9100, TC-9102, XTM, or XT-9100. The MM-CVT101-0 (in Europe, IU-9100) is the device that converts RS-232 to RS-485 for the N2 Bus. It connects a Facilitator™/Companion™ system PC Version or a PC with the Configuration Tools directly to the N2 Bus. This allows downloading, uploading, and commissioning of an ASC, DX-9100, TC-9102, XTM, or XT-9100 via the N2 Bus.

In addition, the End-of-Line (EOL) termination jumpers for the PC Version Companion system are located in the MM-CVT101-0 N2 Bus converter. To set the PC as the terminating device as required for the Companion system or for the second N2 Bus on an NCM, set the jumpers to In by placing them on Pins 1 and 2 of W1 and W2. To set the PC as the non-terminating device, set the jumpers to Out by placing them on Pins 2 and 3 of W1 and W2. Refer to Figure 19 for the MM-CVT101-0 components.

The MM-CVT101 converter has a 25-pin female connector on the body of the converter that plugs-into a 25-pin serial port on the PC directly. PCs with only 9-pin serial ports require a 9-pin female to 25-pin male straight through cable (or converter plug) between the serial port and the MM-CVT101.

Note: If you are using Windows NT software with HVAC PRO software, see the *MM-CVT101-0 with Windows NT and HVAC PRO Software* section.


Plug End to
120 VAC Power Supply

25-pin Female Connector
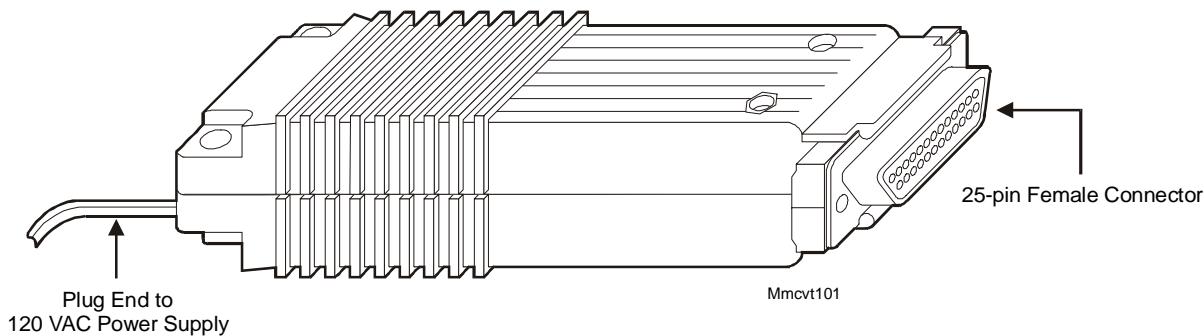
Mmcvt101

Figure 18: MM-CVT101

Note: Pins 20 and 22 must be jumped when using the MM-CVT101-0 with LCPs. Refer to the *LCP Commissioning Tool Technical Bulletin (LIT-636069e) in the System 9100 Technical Manual (FAN 636.4)* for wiring details.

Refer to Figure 19 for illustration of the following:

- J1: Jumpers for changing the transmit/receive communication of Pins 2 and 3 on the 25-pin Electronic Industries Association (EIA) female connector

- P1: 25-pin female connector for connection to a PC (via cable or direct)

- P2: Screw terminal for trunk connections

- P3: Screw terminal for power connections

- W1: Jumper (1) for EOL termination (In/Out)

- W2: Jumper (1) for EOL termination (In/Out)
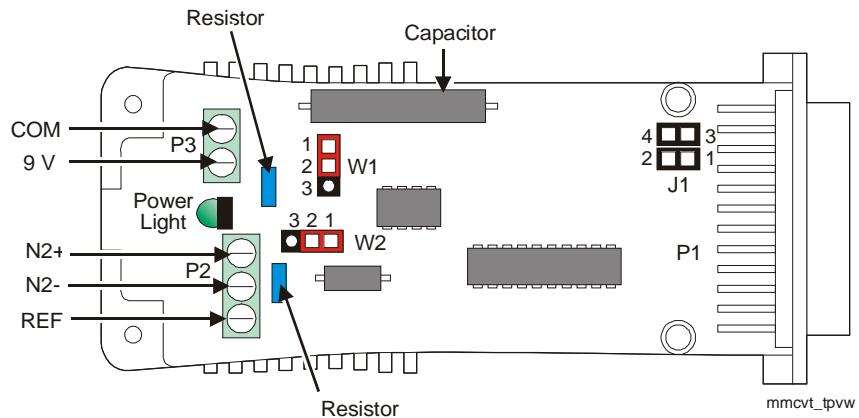
**Figure 19: MM-CVT101-0 Components**

Connection for Download and Upload
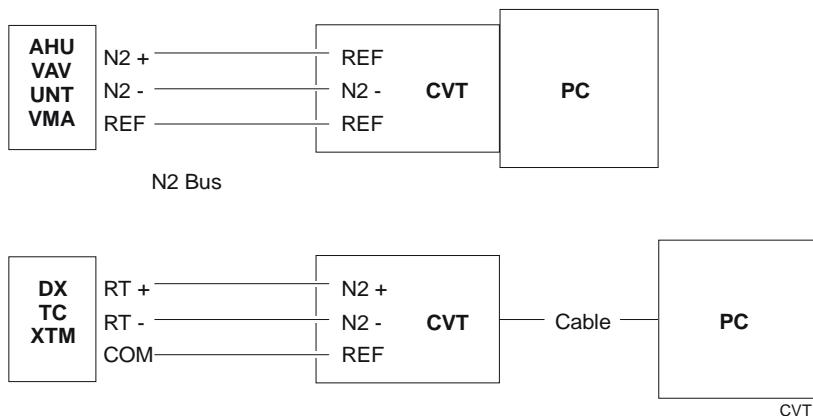
Figure 20: MM-CVT101-0 Connections

HVAC PRO software (Release 7.03 or later) running on Windows NT operating system does not support the MM-CVT101 converter for direct connections to the N2 Bus.

Windows NT system does not create the proper Request to Send (RTS) signal for Johnson Controls devices. Without the proper RTS signal, N2 Bus communication is not established and downloading fails.

Solution: B & B Converter

Replace the MM-CVT101-0 converter with the B & B Electronics converter and power supply shown in Table 13. These parts are available from:

> B & B Electronics
> 707 Dayton Rd.
> P.O. Box 1040
> Ottawa, IL 61350
> Phone: (815) 433-5100

> www.bb-elec.com

See the footnote under Table 13 for special ordering instructions.

Table 13: B & B Electronics Products and Model Numbers

B & B Electronics Product	Model Number
RS-232 to RS-485 Converter	485TBLED*
RS-232 to RS-485 Power Supply for Converter	485PS2

- N2 devices require a faster converter turnaround time. Resistor R9 must be changed from the standard 100K ohm to a 68K ohm, 1%, 1/8 watt resistor. B & B Electronics provides the change for a $15 charge. Request a "modification line item: change R9 to a 68K ohm, 1% resistor" when placing your order.

The B & B converter uses the same cable as the MM-CVT101 to connect to the PC. The B & B converter has two jumpers (see Figure 21). Several changes are required for use with Johnson Controls N2 devices. The B & B converter has separate connections for the transmitting and the receiving N2 lines (see Figure 21). These connections must be connected together to provide a 3-wire communication trunk.

Setting up the B & B converter for use with Johnson Controls N2 devices:

1. Using Figure 21, insert one jumper in the CONTROL SD location and insert the other jumper in the ECHO OFF location. The SD position causes a timed internal RTS signal to be generated when the TD signal is active.

2. Insert an external 100 ohm resistor between the GND terminal and the N2 cable reference wire.

   Note: The external power supply common is also connected to the GND terminal. No connection is made to the FR GND SHIELD terminal on the B & B converter.

3. Connect terminals TD(A) and RD(A) together with an external jumper wire to form the N2- line connection point.

4. Connect terminals TD(B) and RD(B) together with an external jumper wire to form the N2+ connection point.

   Note: the B & B converter does not have provisions for an End-of-Line Resistor (EOLR), therefore increased Retries and Offlines occur.
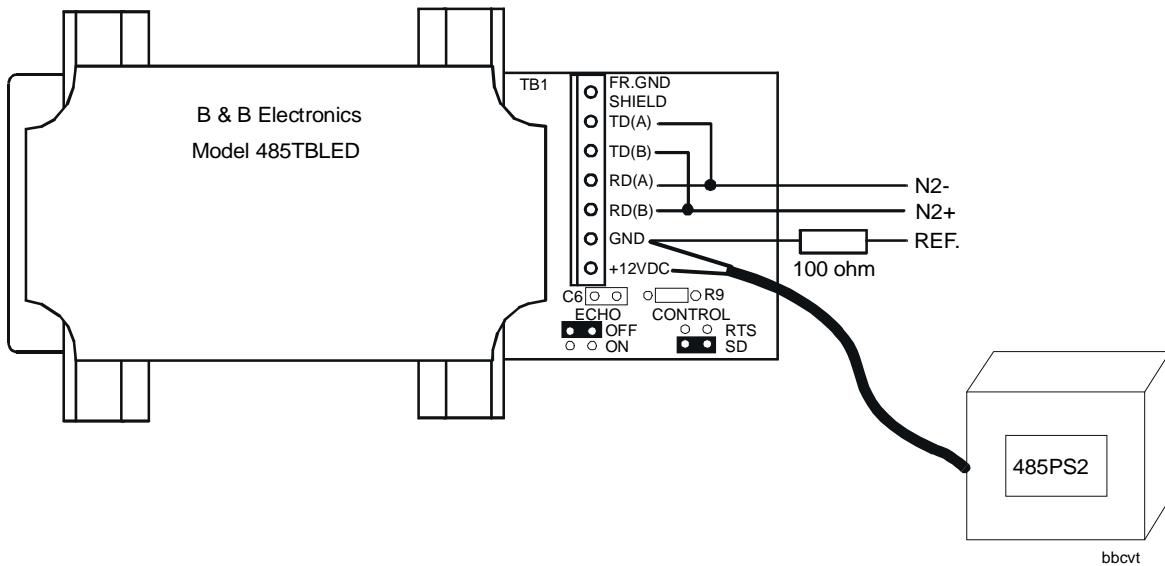

Figure 21: B & B Electronics Converter and Power Supply

MM-CVT101-0 Specifications

Table 14: General Specifications

Product	MM-CVT101-0 RS-232 to RS-485 Protocol Converter
Power Requirements	9 VDC transformer that plugs into a 120 VAC wall outlet
Ambient Operating Conditions	0 to 50ºC (32 to 120ºF) 10 to 90 % non-condensing relative humidity
Ambient Storage Conditions	-40 to 70°C (-40 to 158°F)
Dimensions (H x W x D)	25.4 x 53.3 x 114 mm (1.0 x 2.1 x 4.5 in.)
Shipping Weight	0.54 kg (1.2 lb)

The performance specifications are nominal and conform to acceptable industry standards. For application at conditions beyond these specifications, consult the local Johnson Controls office. Johnson Controls, Inc. shall not be liable for damages resulting from misapplication or misuse of its products.

Relays

Relay Module Description

The relay module is a self-contained relay device that provides an interface between the 24 VAC, low voltage (input) triac circuitry and the 240 VAC 5 ampere line-voltage (output) devices. These relays are used when the triac output is not compatible with the device or the device exceeds the load rating of the triac.

AS-RLY050-0 AS-RLY100-1

The AS-RLY050-0 and AS-RLY100-1 are primarily used with application specific controllers or in applications that require a metal relay enclosure. AS-RLY050-0 has two 24 VAC relays. AS-RLY100-1 has four 24 VAC relays. Both come with enclosures.

AS-RLY002-0

The AS-RLY002-0 is the same relay module used in the AS-RLY050-0 and AS-RLY100-1. You can use the AS-RLY002-0 as a replacement board for either of these modules. The AS-RLY002-0 has two 24 VAC relays.


AS-RLY050-0   AS-RLY100-1   AS-RLY002-0
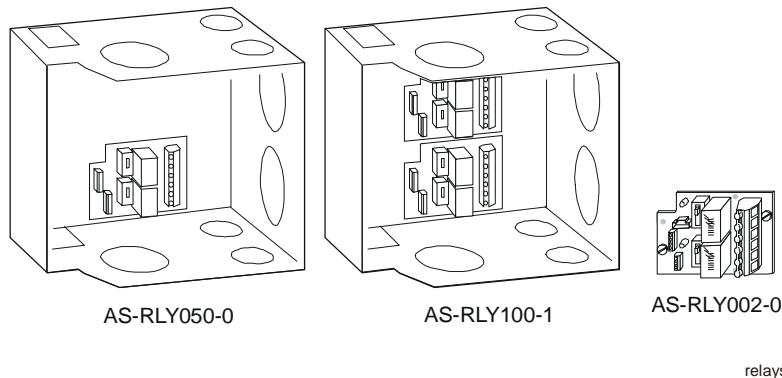
relays

Figure 22: Relay (RLY) Modules

Position the relay module remotely next to the line-voltage device on the DIN rail. The enclosure can be mounted with DIN rail or directly mounted to a wall. The enclosure supports multiple 3/4 in. and 1-1/2 in. conduit connections.

Remote Relay Enclosure

Position the Remote Relay Enclosure (RLY050/100) as close as possible to the devices it operates. The Remote Relay Enclosure measures H x W x D 173 x 186 x 124 mm (6-13/16 x 7-5/16 x 4-7/8 in.).

⚠️ CAUTION: **Possible Equipment Damage or Electrical Shock.**
Disconnect power circuit before wiring Relay Kit.

Refer to Figure 14 when wiring a AS-RLY002-0. To ensure separation of line and control wiring, route all low voltage wiring from the controller on the left-hand side of the UPM and route all line-voltage wiring to the right-hand side as shown in Figure 23. Connect control and binary feedback wires according to the examples in Figure 24. For ease of wiring, use the AS-CBL100-0 with the AHU when the AHU is within three feet of the relay.
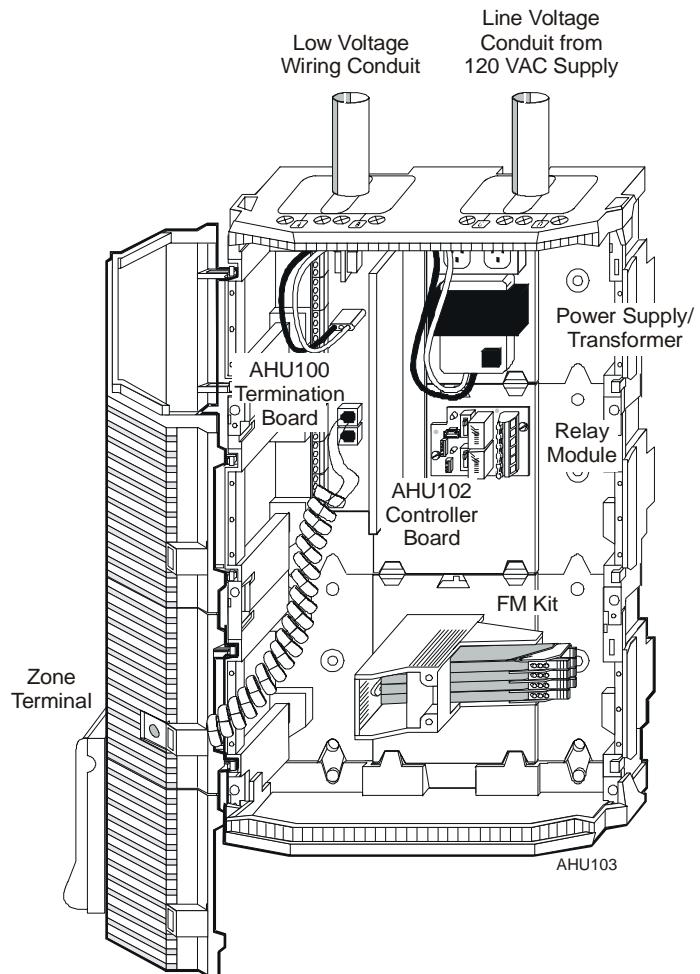

Figure 23: Low Voltage and Line-voltage Wiring

Tables 3 and 4 describe the relay terminals for low voltage and line-voltage wiring.

Table 15: Wiring Terminals-Low Voltage

Relay Terminal	Description
A or C	Relay control, switched 24 VAC from Binary Output (BO) (odd number BO using CBL100)
B or D	Relay control, switched 24 VAC from Binary Output (even number BO using CBL100)
Coils	Relay coil supply, connected to both relay coils (typically 24 VAC)
Triacs	Triac voltage common, used to energize Relay in Hand switch position
Hand	Binary contact feedback, closed indicates when HOA relay switch is in the Hand position
Off	Binary contact feedback, closed indicates when either HOA switch is in the Off position
HOA Com	Binary Input common for Hand/Off feedback

Table 16: Wiring Terminals-Line-voltage (240 VAC 5 Ampere Maximum)

Relay Terminal	Description
COM	Common Relay Contact
NC	Normally Closed Relay Contact
NO	Normally Open Contact

AS-AHU100 (or VAV)

BO 1
24 V
BO 2

A

COM
NC
NO
COM
NC
NO

B

Motor
Starter

Motor
Starter

BI 7
BICOM
BI 8

A
B
COILS
TRIAC
HAND
OFF
HOA
COM

L1   L2

120/220
VAC

AS-RLY050-0 / AS-RLYOO2-0

BO 1
24 AC
BO 2

AS-CBL100

BO 5
24 AC
BO 6

AS-AHU100

A
B

A

B

C
D

C

D

BI 7
BICOM
BI 8

HAND
OFF
HOA
COM

AS-RLY100-1 / AS-RLY002-0

RLYDIA2
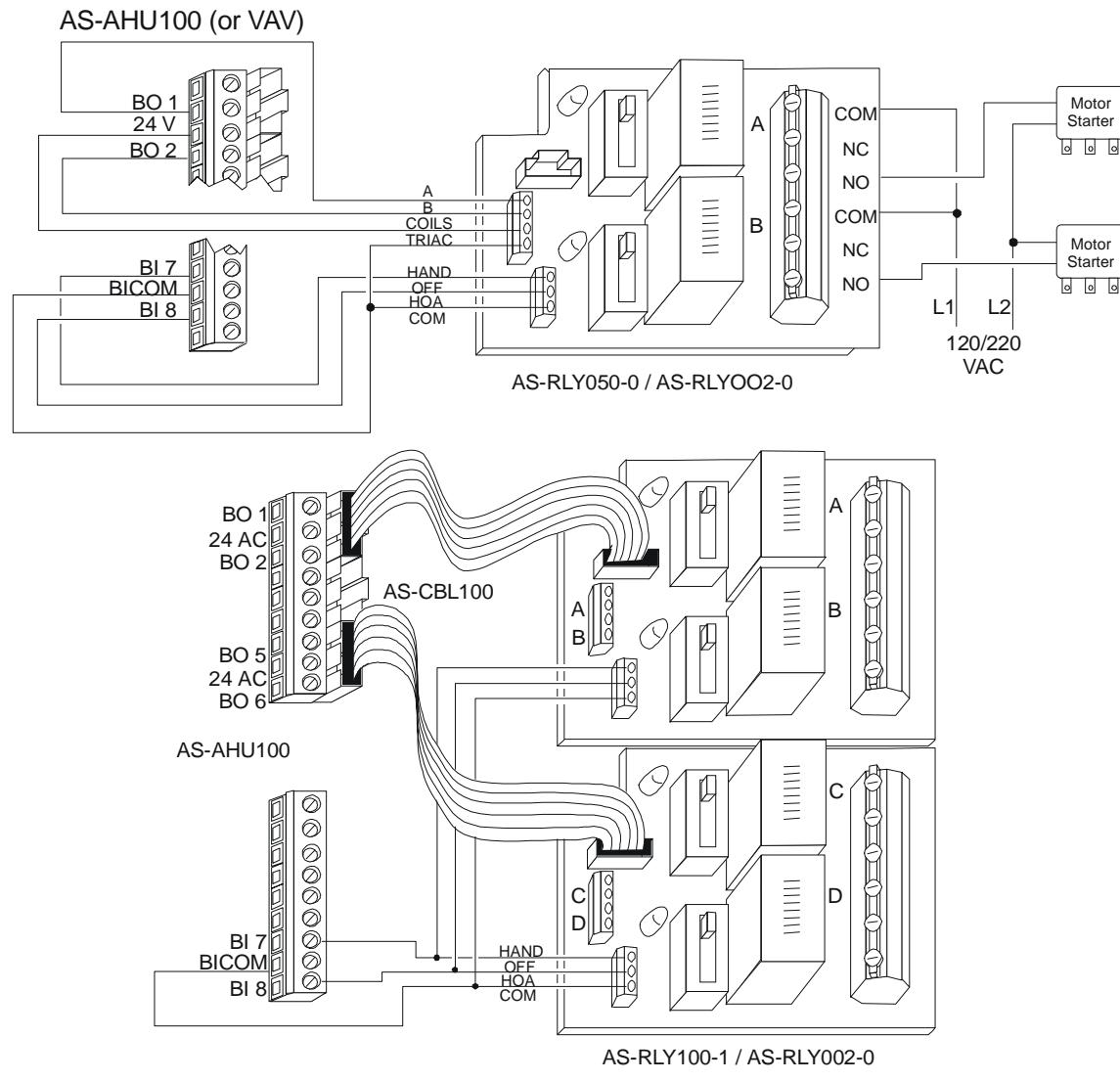
Figure 24: Relay Wiring Examples

Connect power to the relay module and the transformer through the conduit knockouts in each box. Wire the module according to the following diagrams.
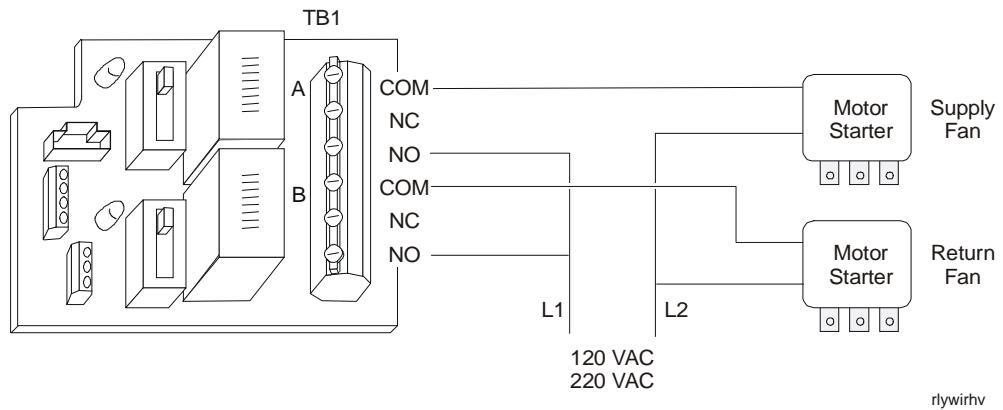

Figure 25: Starter Interlock Wiring Example

| IMPORTANT:	**Chattering Relays Driven By Binary Outputs--** Chattering may occasionally occur in relays from manufacturers other than Johnson Controls. This is due to a low load current through the binary output triac. The chattering relays are audible and arcing may be visible at the contacts.
	The minimum holding current for the triac is 50 mA. The maximum triac current is 500 mA. To eliminate chattering, use a 360 ohm, 5-watt resistor across the binary output (or use the AS-RLY100 Relay Kit).
	There have been a few instances where loads have met the 50 mA current requirements, but still chattered. To date, the exceptions are Honeywell® damper actuator (Model MC6161) and Finder relay (Model 60.12). In these instances, use a 1K ohm, 2-watt resistor in parallel with the load.
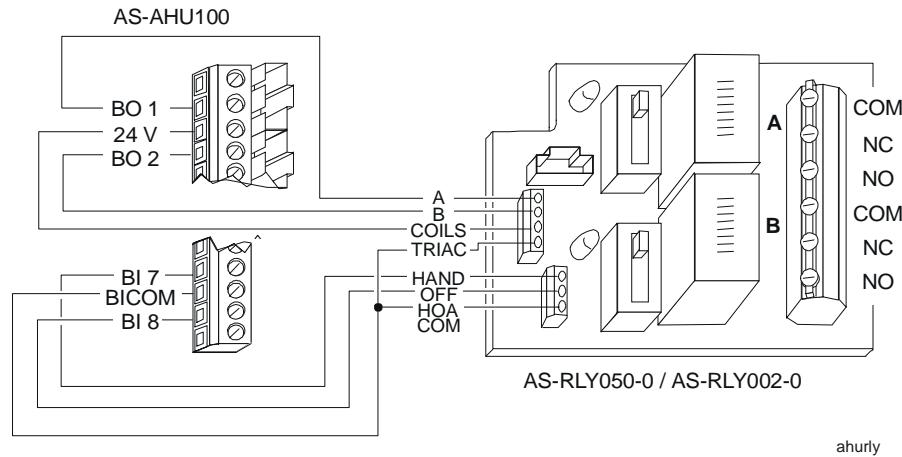
Figure 26: Wiring Example--AHU to RLY050 or RLY002

Important points to remember while wiring relays:

- Separate low voltage and line wiring, with line-voltage on the right.

- Hand operation using the H/O/A switch requires 24 VAC to the COILS terminal and COM to the TRIAC terminal to energize the relay.

- The Hand or Off position signals the binary input connected to those terminals. These switches can be a hardware "**or**" connected to one BI. This switch uses the HOA COM terminal, which is isolated from the relays.

- Obtain a Double-Pole, Double-Throw (DPDT) relay configuration by connecting the BO signal to two terminals on the Relay Kit terminal block (e.g., B and C).

To supply a Zone Bus jack at a remote RLY kit, add an AS-CBLCON-0.
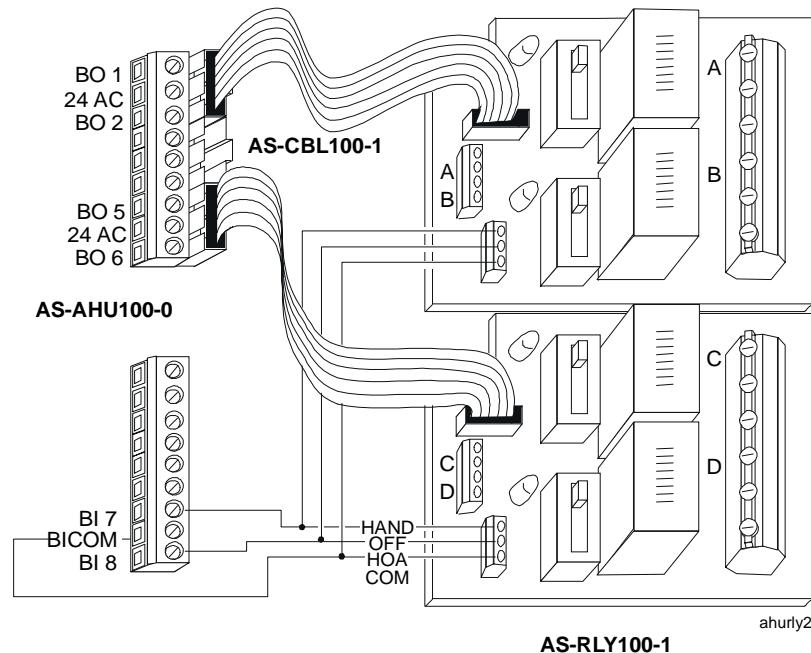
Figure 27: Wiring Binary Outputs with AS-CBL100 Quick Connect Cable

Use the AS-CBL100-0 Quick Connect Cable to connect AHU binary outputs to relays within three feet. Each cable can connect two binary outputs to two relays. Figure 27 shows:

- BO 1 and BO 2 controlling Relays A and B
- BO 5 and BO 6 controlling Relays C and D

You will, however, need to hardwire Hand and Off terminals on the relay kit to the BI terminals on the controller. Figure 28 is a schematic diagram of the relay module with an AHU controller.
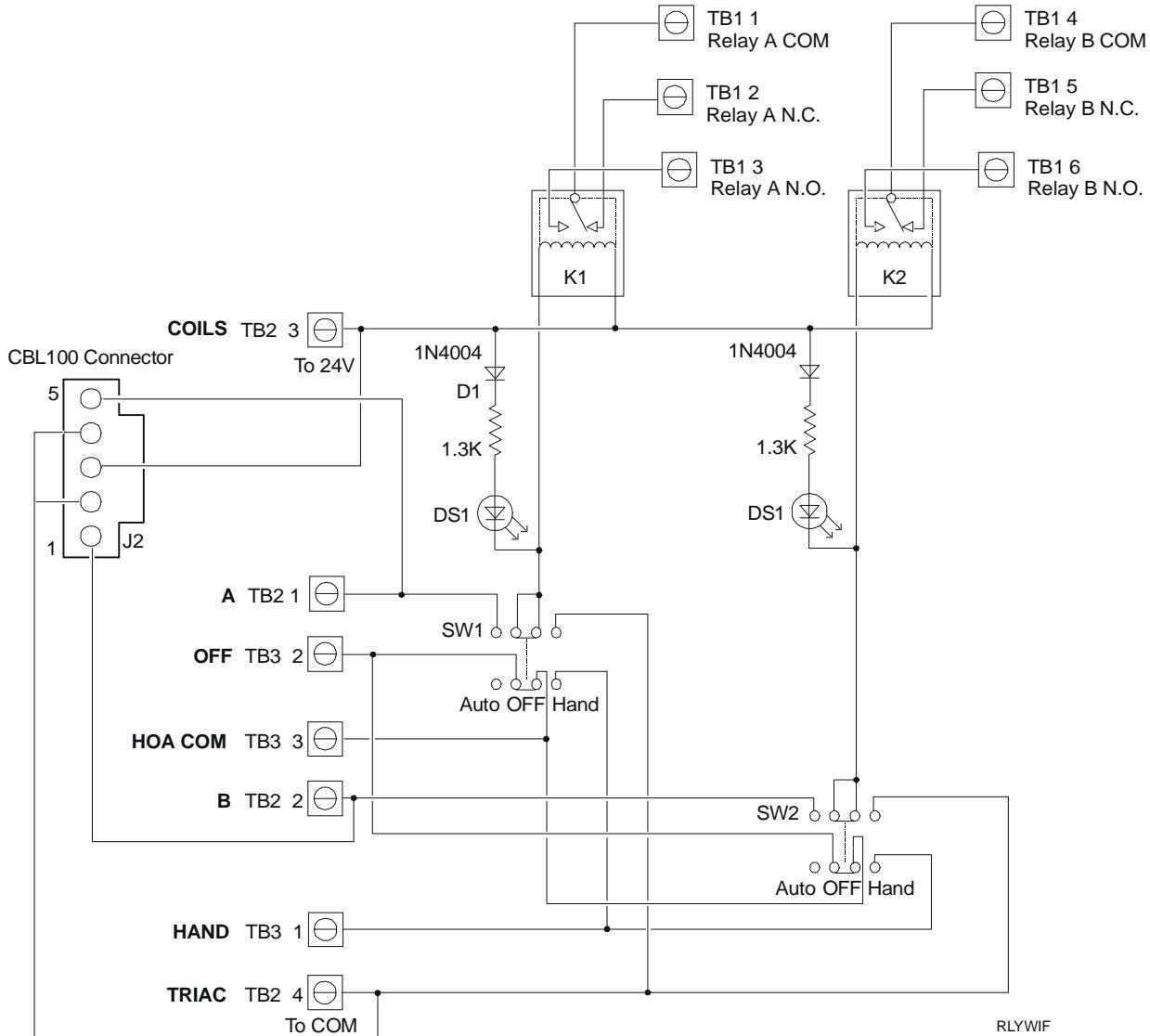

Figure 28: Schematic Diagram of the Relay Module

Table 17: Relay Module

RLY Terminal	Description
A	Relay control from BO, switched 24 VAC or common. (Device Dependent)
B	Relay Control from BO, switched 24 VAC or common. (Device Dependent)
Coils	Relay coil supply to both relay coils, 24 VAC or common. (Device Dependent)
Triac	Triac voltage supply, used to energize relay in hand switch position, 24 VAC or common. (Must be opposite coil voltage.)
Hand	Binary Contact Feedback, closed indicates when either HOA switch is in the Hand position.
Off	Binary Contact Feedback, closed indicates when either HOA switch is in the Off position.
HOA Com	Binary Input common for Hand/Off feedback.

UNT Relay Wiring Examples

The UNT110/111 can be wired to an RLY050/002 with no BOs isolated from earth ground.

Low Voltage — High Voltage (See Note 1.)
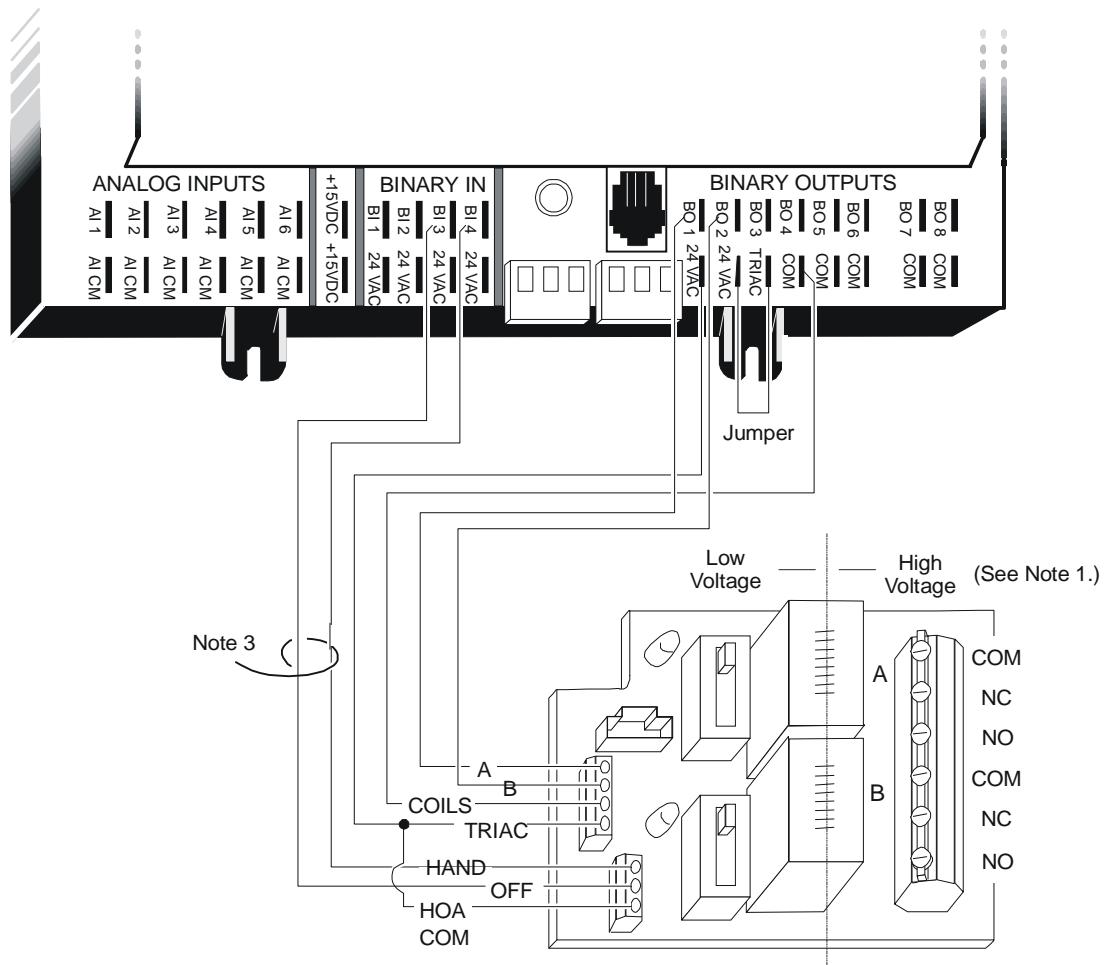
AS-RLY050-0/AS-RLY002-0

unt1ahu

Note 1: Separate low voltage wiring on the left from line-voltage wiring on the right.
Note 2: Hand operation using the H/O/A switch requires common to the COILS terminal and 24 VAC to the TRIAC terminal to energize the relay.
Note 3: The Hand or Off position signals the binary input connected to those terminals. These switches can be hardwire "OR"ed and connected to one BI. This switch uses the HOA COM terminal, which is isolated from the relays.
Note 4: Your application will determine exact connections to UNT.

Figure 29: UNT110/111 Wired to RLY050/002

Figure 29 shows a jumper between 24 VAC and the triac. If the jumper is between the triac and common, make the following changes:

1. Disconnect TRIAC from HOA COM.

2. Reverse the COILS and TRIAC wires from RLY050 to the UNT.

3. Run a separate wire from HOA COM to 24 VAC at the Binary In terminal section.

Figure 30 shows a UNT110/111 wired to an RLY050/002 with all BOs isolated from earth ground.
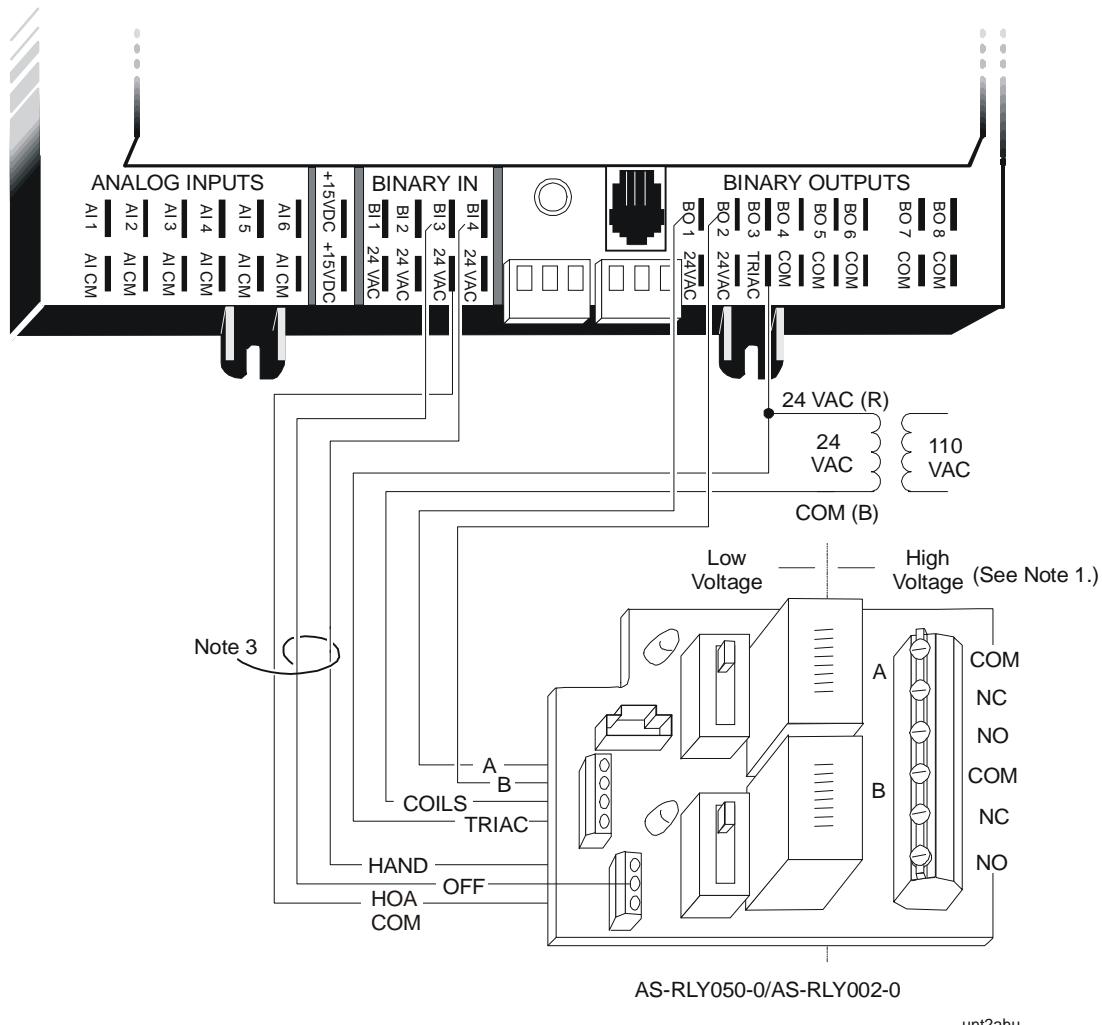

Note 1: Separate low voltage wiring on the left from line-voltage wiring on the right.
Note 2: Hand operation using the H/O/A switch requires common to the COILS
      terminal and 24 VAC to the TRIAC terminal to energize the relay.
Note 3: The Hand or Off position signals the binary input connected to those terminals.
      These switches can be hardwire "OR"ed and connected to one BI.
      This switch uses the HOA COM terminal, which is isolated from the relays.
Note 4: Your application will determine exact connections to UNT.

Figure 30: UNT110/111 Wired to RLY050/002 with Isolated BOs

Obtain a Double-Pole, Double-Throw (DPDT) relay configuration by connecting the BO signal to two terminals on the relay kit terminal block (e.g., B and C). If you require a phone jack at a remote relay kit, add an AS-CBLCON-0.

Table 18: RLY Specifications

Product	AS-RLY100-1	4 Relays
	AS-RLY050-0	2 Relays
	AS-RLY002-0	2 Relays
Power Requirements		Input Coil Ratings: 24 VAC, maximum 0.05 amperes
		Output Coil Ratings: general purpose, 250 VAC, maximum 5.0 amperes or pilot duty, 120 VAC, maximum 345 VA
Electrical Rating	AS-RLY100-1	4 Triac to 24 VAC, Single-Pole, Double-Throw (SPDT) relays
	AS-RLY050-0	2 Triac to 24 VAC, SPDT relays
	AS-RLY002-0	
Ambient Operating Conditions		0 to 50ºC (32 to 120ºF)
Ambient Storage Conditions		-40 to 69ºC (-40 to 158ºF)
Dimensions (H x W x D)	AS-RLY100-1	171.5 x 187.2 x 117.3 mm (6.75 x 7.37 x 4.62 in.)
	AS-RLY050-0	
	AS-RLY002-0	66.5 x 98.3 x 47.5 mm (2.62 x 3.87 x 1.87 in.)
Shipping Weight	AS-RLY100-1	1.05 kg (2.3 lb)
	AS-RLY050-0	0.95 kg (2.1 lb)
	AS-RLY002-0	0.1 kg (0.2 lb)
Enclosure	AS-RLY100-1	AS-ENC100
	AS-RLY050-0	AS-ENC100
	AS-RLY002-0	None
Agency Compliance		UL 864/916 and CSA C22.2 No. 205
Agency Listing		UL Listed and CSA Certified

The performance specifications are nominal and conform to acceptable industry standards. For application at conditions beyond these specifications, consult the local Johnson Controls office. Johnson Controls, Inc. shall not be liable for damages resulting from misapplication or misuse of its products.

Transformer Modules

Transformer Module Description

Transformer modules provide 120 VAC to 24 VAC isolation. It is a device used to power digital controllers and input/output loads. All models include a split-bobbin for added noise immunity and a manually resetable breaker on the secondary connection. All models also have a modular connector on the secondary connection for use with AHU controller and Companion products.

The AS-XFR100-1 is a 92 VA transformer that is pre-mounted in an AS-ENC100 enclosure, it includes a power switch and a utility outlet. The enclosure can be mounted with a DIN rail or directly mounted to a wall. The enclosure supports multiple 3/4 in. and 1-1/2 in. conduit connections.

The AS-XFR050-0 is a 50 VA transformer without an enclosure. It can be used in any appropriate UL Listed enclosure and is used as a replacement transformer.

The same transformer that is provided in the AS-XFR100-1 and the UPM enclosure series is available as a separate item. The AS-XFR010-1 is a 92 VA transformer without any enclosure, and it is wired the same way as the AS-XFR100-1 and AS-XFR050-0.

Transformer Module Wiring (AS-XFR100-1) (AS-XFR050-0) (AS-XFR010-1)

To wire the power source:

- Connect the green ground wire (pulled with the power) to the ground screw in the AS-XFR100-1 enclosure. The green outlet wire must also be attached there.

- Bring 120 VAC 60 Hz into top right portion of the transformer module enclosure. Connect the black (hot), white (neutral), and green (ground) wires.
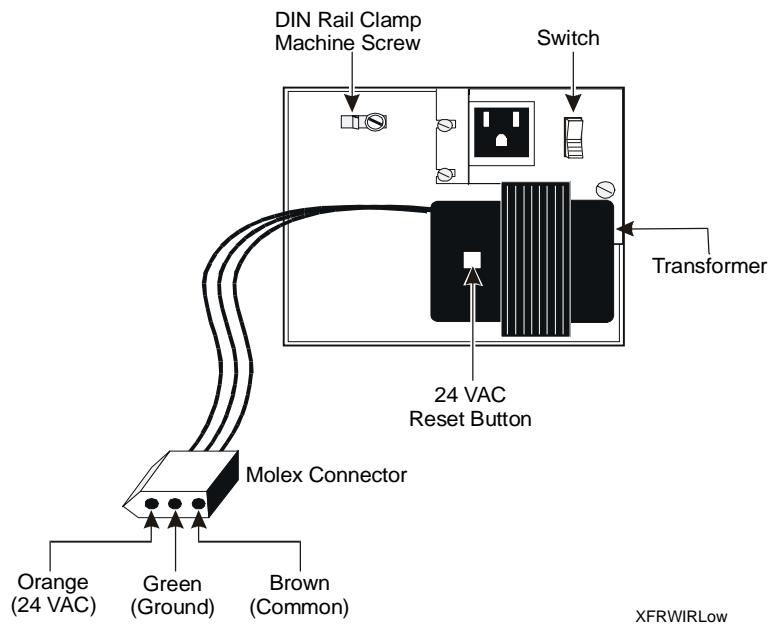
Figure 31: Transformer Wiring Details

Note: In Figure 31 the Switch controls power to the transformer. The utility outlet is not switched.

Transformer Modules Specifications

Table 19: Transformer Module Specifications

Products	AS-XFR100-1, AS-XFR050-0, AS-XFR010-1 Split-Bobbin Transformers	
Wiring Connections	AS-XFR100-1 AS-XFR010-1	Primary: 18 AWG, 12 in., black, while, green/yellow, striped 3/8 in.
		Secondary: 16 AWG, 20 in. brown, orange, Molex connector
	AS-XFR050-0	Primary: 18 AWG, 12 in., black, while, green/yellow, striped 3/8 in.
		Secondary: 18 AWG, 20 in. brown, orange, green/yellow, Molex connector
Electrical Rating	AS-XFR100-1 AS-XFR010-1	92 VA (primary: 120 VAC/60 Hz and secondary: 24 VAC/60 Hz)
	AS-XFR050-0	50 VA (primary: 120 VAC/60 Hz and secondary: 24 VAC/60 Hz)
Ambient Operating Conditions		0 to 50ºC (32 to 120ºF)
Ambient Storage Conditions		-40 to 70°C (-40 to 158°F)
Dimensions (H x W x D)	AS-XFR100-1	171.5 x 187.2 x 117.3 mm (6.75 x 7.37 x 4.62 in.)
	AS-XFR050-0	71.1 x 114.3 x 82.5 mm (2.8 x 4.5 x 3.25 in.)
	AS-XFR010-1	95.2 x 95.2 x 79.4 mm (3.75 x 3.75 x 3.125 in.)
Shipping Weight	AS-XFR100-1	3.05 kg (6.7 lb)
	AS-XFR050-0	2.15 kg (2.6 lb)
	AS-XFR010-1	2.22 kg (4.9 lb)
Enclosure	AS-XFR100-1	AS-ENC100
Agency Compliance		UL 864/916 and CSZ C22.2 No. 205
Agency Listing		UL Listed and CSA Certified

The performance specifications are nominal and conform to acceptable industry standards. For application at conditions beyond these specifications, consult the local Johnson Controls office. Johnson Controls, Inc. shall not be liable for damages resulting from misapplication or misuse of its products.

Ordering Information

Table 15: Auxiliary Gear

Code Number	Description
A-4000-137	Pneumatic replacement filter kit for FM-OAP102
AS-CBL100-0	Cable Kit: RLY050/100/020 and FMK100 interconnect cables (bag of 10)
AS-CBLCON-0	Three 6-pin and two 8-pin phone jacks with a Zone Bus screw terminal block and ZT download switch
AS-CBLPRO-2	Interface converter kit for HVAC PRO software on a PC to the Zone Bus
AS-CBLZT66-0	Replacement Cable for ZTU (6-pin to 6-pin)
AS-CBLZT68-0	Replacement Cable for CBLCON (6-pin to 8-pin)
AS-CVTPRO100-0	Zone/N2 Bus Interface Converter with power (North American version)
AS-CVTPRO200-0	Zone/N2 Bus Interface Converter without power (European version)
AS-CVTPRO-700	CVTPRO unit without cables or case
AS-CVTCBL-700	Replacement set of cables used with the CVTPRO converter
AS-ENC100	Multi-purpose metal enclosure
AS-FMK102-0	Function Module Kit for UPMs: enclosure for FMs; order FMs separately.
AS-RLY002-0	Relay Kit: board with two relays only
AS-RLY050-0	Relay Kit: metal enclosure and board with two relays
AS-RLY100-1	Relay Kit: metal enclosure and board with four relays
AS-XFR010-1	92 VA Split-bobbin Transformer
AS-XFR050-1	50 VA Split-bobbin Transformer
AS-XFR100-1	Transformer Kit: box-mounted split-bobbin transformer for site power isolation of 120 VAC to 24 VAC, with cables, outlet, and power switch
AS-ZTU100-1 or FA-ZTU100-1	Zone Terminal Unit * (Use AS-CBLPRO-2 to communicate with ZTUs. AS-CVTPROx00-0 is incompatible with ZTUs at this time.)
FM-IAP101-0	Function Module—input: 0 to 25 psi, 4 to 20 mA
FM-IDP001-0	Function Module—input: 0 to 0.1 in. W.C., 4 to 20 mA
FM-IDP002-0	Function Module—input: 0 to 0.25 in. W.C., 4 to 20 mA
FM-IDP005-0	Function Module—input: 0 to 0.5 in. W.C., 4 to 20 mA
FM-IDP010-0	Function Module—input: 0 to 1 in. W.C., 4 to 20 mA
FM-IDP030-0	Function Module—input: 0 to 3 in. W.C., 4 to 20 mA
FM-IDP050-0	Function Module—input: 0 to 5 in. W.C., 4 to 20 mA
FM-IDP100-0	Function Module—input: 0 to 10 in. W.C., 4 to 20 mA
FM-OAP102-0	Function Module—manual override kit includes pneumatic air line filter kit (requires FM-OAP103)
FM-OAP103-0	Function Module—output: 0 to 20 mA/psi range, user selectable.
FM-PCM101-0	10 pack of barbed fitting for IDPs and IAPs
M100C	Zone Bus Damper Actuator
MM-CVT101-0	RS-232 to RS-485 for N2 Bus Converter

*AS indicates the Metasys system and FA indicates the Facilitator system.

Notes

JOHNSON CONTROLS